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ORIGINAL MEMOIRS.

PARATHYROIDS AND THEIR SURGICAL RELATION TO GOITRE.*

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AND

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DURING the past several years the parathyroids have been studied by various methods, and, although our definite knowledge of their physiologic function and pathologic importance is limited, to-day we are justified in saying that these little glands are concerned in the metabolism of the body, and, consequently, that disturbances of them are of serious interest to both the internist and the surgeon. But, what seems to be the natural course in matters medical, the parathyroids, once recognized, became the object of numerous hypotheses. Theories have been advanced and diseases attributed to these structures without having the support of scientific investigation. Erroneous deductions have been made from defective experimentation, histologic conditions overlooked, and the findings misinterpreted. Illogical conclusions have been based on the administration of therapeutic agents, as, for example, the failure of parathyroid extract to control the attacks of

*Read before the Southern Surgical and Gynecological Society, December 14, 1911.

tetany. However, recent and more exact methods of examination have dissipated many of those erroneous views and caused our minds to be focussed upon something definite.

There no longer seems to be substantial grounds for doubting the etiologic relationship between the parathyroids and one disease, namely tetany.

Experimental tetany has been produced in animals by the removal of parathyroidal tissue, and experimental tetany may be reckoned, in a certain sense, tetany following operation upon the human thyroid gland.

Histologic investigations of recent times have not only confirmed the results of experimental work, but also demonstrated that *spontaneous tetany* is caused by an *hypoplasia* with resultant *insufficiency* of the parathyroids. Therefore, in this paper we shall discuss these glands in their relation to the disease of tetany, but, before considering the *surgical* aspect of the subject, we shall briefly review some of the later works on the *spontaneous* form of this disease.

Tetany manifests itself by spasmodic attacks, which usually occur bilaterally, are often associated with intense pain, sometimes with slight cedema of the face, hands, and feet, and the latter have a tendency to assume a partial equinovarus position. In the *interval* between the attacks, the principal diagnostic points are *Trousseau's sign*, a peculiar tonic spasm of the fingers and thumb, the so-called *obstetric hand*, produced by prolonged, severe pressure upon the nerve-trunks, particularly the median nerve; *Chvostek's sign*, twitching of the facial muscles, elicited by tapping upon the trunk of the facial nerve, upon the malar bone, or over the infra-orbital foramen; *Erb's sign*, galvanic hyperirritability of the muscles, which contract to very weak currents; *Hoffman's sign*, extreme sensitiveness to the induced current.

tetany of childhood, and that these hemorrhages produce their effect by injuring the parathyroidal tissue, inhibiting its development, and, consequently, decreasing its functional power. Haberfeld has recently reported six cases of undoubted *tetania infantum*, whose parathyroids showed hemorrhages, which manifested themselves partly as blood-cysts and partly as old hemorrhages with hæmatogenous pigment. It has not been possible to positively fix the exact time of the bleeding, but many points favor Erdheim's view, namely, that it takes place during labor. In support of this opinion are very young cases (four weeks, four months old), presenting *old* hemorrhages, and the fact that the parathyroids are not disposed to bleeding, so that the mechanism of labor with its associated trauma can very likely play an important part. The explanation has been advanced that in extreme flexion of the child's head the chin presses upon the region of the parathyroids, and thereby injury is produced.

In this connection another point of interest has been revealed. Several of Haberfeld's cases showed absence of valves in the veins of the affected parathyroids, while the valves were present in the glands which were intact. Therefore, deficiency of venous valves has also been considered by recent investigators as contributing to the occurrence of these hemorrhages, since it is maintained that in the presence of increased blood-pressure these valves are a safeguard against bleeding. It has been suggested that these hemorrhages in the parathyroids are the *effects* of the convulsive attacks and *not* the *cause* of the tetany. Cases have been reported in which autopsy revealed not only hemorrhages in these glands but also areas of recent bleeding in the pericardium and the pleuræ. However, special methods of examination positively proved that the hemorrhages in the parathyroids antedated the beginning of the convulsive seizures, consequently could not have been caused by them.

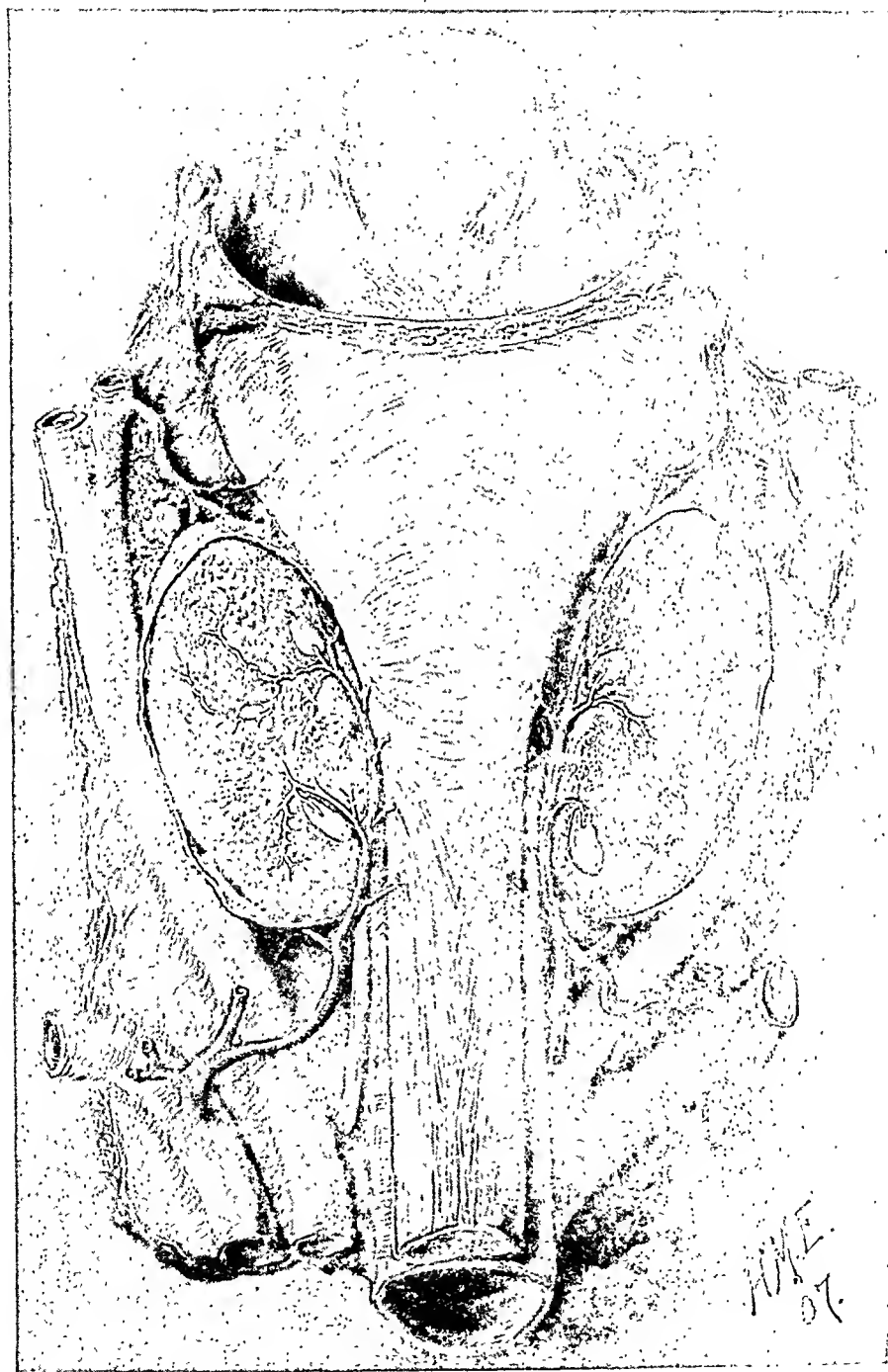
An objection that has been advanced against the hemorrhagic theory, and one that deserves discussion, is the fact that the attack of tetany does not occur at the time of bleeding,

but instead manifests itself very often only after the hemorrhages have been completely healed. That injury of the parathyroids takes place when the bleeding occurs is to be admitted, and that tetany does not appear simultaneously with the injury are facts which seem to be grounds for rejecting this theory. Escherich explains this apparent contradiction as follows: The central nervous system of the new-born is so insensitive that the clinical picture of tetany cannot manifest itself, and that such manifestation is only possible beginning with the third month. Escherich's view seems to be supported by the facts that the brain of the foetus contains the highest amount of calcium (Quest), and that here calcium decreases with advancing age. Sabbatini has demonstrated that cerebral irritability is lowered by an increase of calcium and raised by withdrawal of the same. Therefore, it is concluded, tetany does not occur at the time of bleeding, because at this period the brain's irritability is very slight, which is due to the presence of a larger amount of calcium.

With regard to the importance of calcium in the condition of tetany, the writers refer to the observations of MacCallum and Voegtlin. These investigators have undertaken a study of the calcium metabolism of animals, in which this disease is produced by parathyroidectomy, and are endeavoring to demonstrate the relation of various salts, especially those of calcium, to experimental tetany. They state that all violent symptoms produced by parathyroidectomy—muscular twitching and rigidity, tachypnoea, fibrillary tremors, increased rapidity of the heart-beat, etc.—may be almost instantly cured by the intravenous injection of a solution of a calcium salt. The acetate or lactate in 5 per cent. solution is usually employed. Subcutaneous injection or the introduction of the solution into the stomach is quite as effective, but acts more slowly. The results from the use of magnesium are similar, but its otherwise bad effects contraindicate its employment.

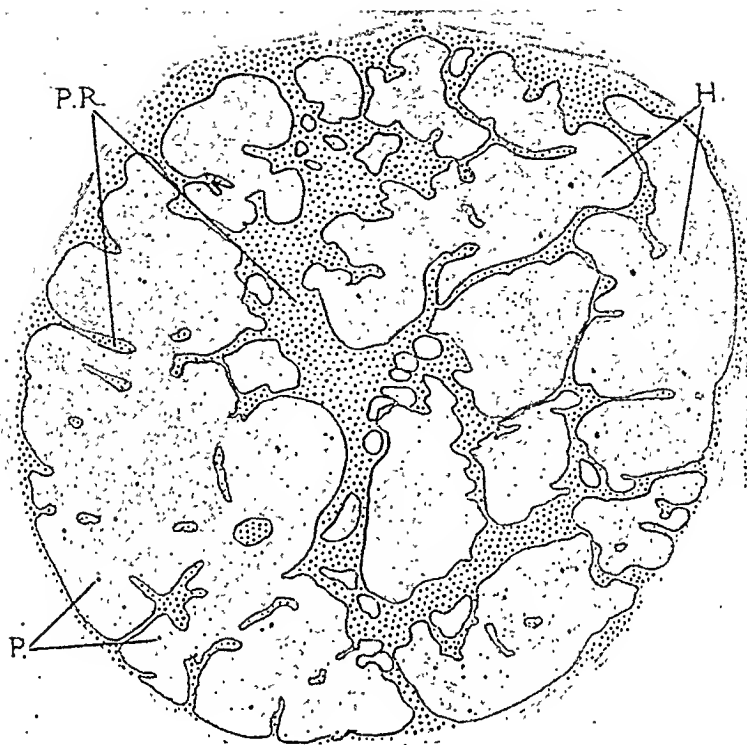
The condition of relief following the administration of these various salts lasts for perhaps 24 hours, when tetany

FIG. 1.



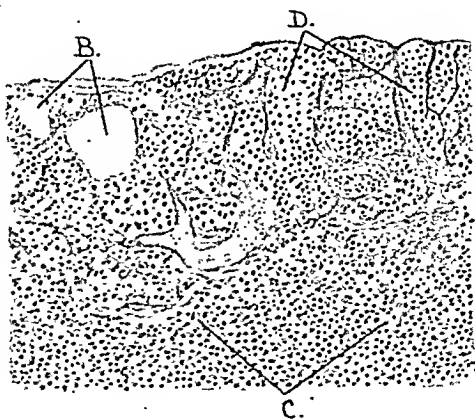
Parathyroid glandules.

FIG. 2.



* Cross-section through right superior parathyroid. Tetany, patient aged five months. Almost entire parathyroidal tissue destroyed by enormous hemorrhages. *H*, remains of parenchyma in the centre and assepta between the blood cysts, *P.R.* Many phagocytes (*P*) with pigment in the blood cysts, consequently signs of old hemorrhages. The zone of development completely absent. (After Haberfeld.)

FIG. 3.



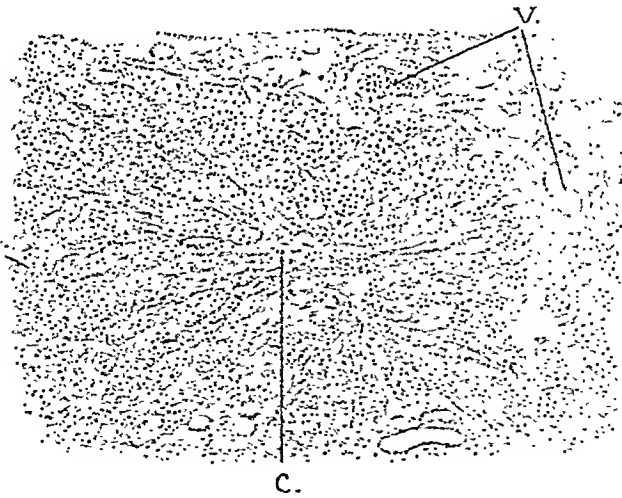
Small area of a parathyroid. Tetany, patient aged five months. *C*, small dark cells of the centre; *D*, zone of development showing large light cells which are absent at *B*, replaced by blood cysts (old hemorrhages). (After Haberfeld.)

FIG. 4.

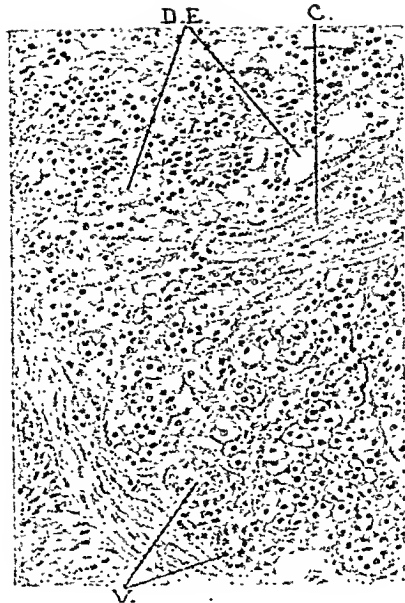


Tetany, patient aged 24 years. Amyloid degeneration of small vessels. *A*, cells near vessels show hydropsical degeneration, absence of nuclei, and swelling of protoplasm; *C*, loss of cell membrane with cavity formation; *P*, normal appearing parathyroidal cells. (After Haberfeld.)

FIG. 5.

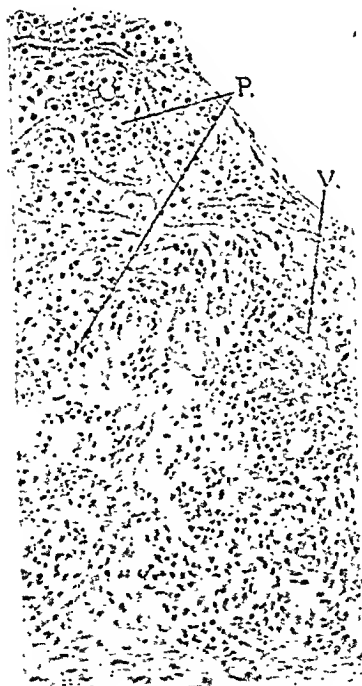


Tetania gravidarum. Patient aged 31 years. $\times 50$. Area of a parathyroid showing moderately large, radiating cicatrix (*C*); vessels (*V*). (After Haberfeld.)



Same case as Fig. 5. $\times 125$. Part of the cicatrix (C) is seen. Individual epithelial cells in this region swollen in place uniting and forming small cavities (D.E.). Vessels (V). (After Haberfeld.)

FIG. 7.



Same case as Figs. 5 and 6. $\times 160$. Small area of a parathyroid which is almost completely atrophied. The section shows for the most part connective-tissue bands bearing many small vessels. Remains of original parenchyma (P); vessels (V). (After Haberfeld.)

may reappear. Analysis of the blood taken from a dog during tetany shows a calcium content which is only about half that of the normal dog on the same diet. These writers state that from their observations up to the present it is possible to construct at least a plausible, working hypothesis by which to explain their results. Apparently the parathyroids control in some way the calcium metabolism, so that upon their removal a rapid excretion, possibly associated with inadequate absorption and assimilation, deprives the tissues of calcium salts. In the case of tetany the central nervous system seems to be especially affected, as has been demonstrated by experiments in which muscles isolated from the central nervous system presented no twitching during the attacks.

However the salts of calcium and other salts may be concerned in maintaining a state of equilibrium in the function of the nervous system, and whatever may be the relation of the parathyroids to calcium and other metabolism, recent investigators state that all their experiences with tetany have shown that *insufficiency of these glands* is necessary for the production of tetany. This insufficiency occurs in experiments through removal of parathyroidal tissue; and in the *idiopathic tetany* of man it is caused by an hypoplasia of the parathyroids in consequence of pathologic processes.

In children there have been found hemorrhages, which, when they were relatively fresh and large (blood-cysts), presented evident severe injury of the parathyroids. But how is the insufficiency and therewith the tetany to be explained when even before the outbreak of the disease these blood-cysts have been gradually absorbed and only more or less blood pigment is to be found? As Erdheim has stated, by itself this pigment can scarcely produce injury of the parenchyma, but in spite of that fact it must be looked upon as the expression of a tissue injury which causes insufficiency of the parathyroids. Whereas it is not to be supposed that every hemorrhage in these glands produces hypoplasia, yet Yanase had never been able to demonstrate clinically normal galvanic irritability in any child whose parathyroids showed anatomically hemorrhages, even in slight amount.

Tetany is not to be explained alone by injury of parathyroidal tissue. There have been cases in which the glands were undoubtedly injured, that is, parathyroids disposed to tetany, but the attacks did not occur until another factor entered, for example, gastro-intestinal disease. Therefore, these patients lived for many years with defective parathyroidal tissue and were not seized with tetany until a contributing factor, whereby an excess of the toxic material was produced, caused hypofunction of the glands to be manifested. Beside the hypoplasia resulting from hemorrhages, other conditions have been noted in association with deficient development and insufficiency of the parathyroids. Haberfeld cites two cases of congenital syphilis, in which tetany developed and the parathyroids were shown histologically to be hypoplastic.

The same investigator was the first to examine the parathyroids in a case of tetany occurring in pregnancy. All four of the parathyroids showed pathologic changes, which included large scars, parenchymatous atrophy, and cysts. Therefore, basing their conclusions on experimental, clinical, and pathologico-anatomic investigations, recent writers state that the principal factor in the production of tetany is *insufficiency of the parathyroids*. This insufficiency may be either *absolute*, that is, referred alone to the glands, as by their absence (operative tetany), or relative, in which case the parathyroids are hypoplastic, consequently disposed to tetany, and hypofunction is precipitated by a contributing factor, as, for example, gastro-intestinal disease. The latter form seems from investigations to be the more frequent, and, for the tetany of children, is almost a law. Accordingly, injury of the parathyroids is to be regarded as disposing to tetany, while the releasing factor, whose nature still remains obscure, is undoubtedly of a very varying kind (infection, pregnancy, etc.). It is probable that the parathyroids, like other glands of the body, have factors of safety, which is somewhere between two and four times.

Surgical Importance of the Parathyroids.—Viewed in the light of all the experimental, clinical, and histologic works

which have been done, these glands are to be regarded as structures possessing a function that is essential at least for the normal metabolism of the body. Although the results of animal experimentation are not uniform with regard to some points, yet they have proven that removal of parathyroidal tissue is usually followed by a symptom complex, which is termed *experimental tetany*.

Histologic examinations have shown pathologic changes in the parathyroids of typical cases of spontaneous tetany, and that these changes represent a *hypoplasia*, deficient development of the glands, which disposes to insufficiency of function, and also that these structural defects seem at times to be the result of trauma. Consequently, guided by these scientifically supported facts, the surgeon should scrupulously guard against removal or injury of the parathyroids. Remembering their variable size, location, and appearance, the operator should preserve all small, especially gland-like masses about the capsule in case of operation on the thyroid gland. If such a mass be accidentally removed in the course of operation, it should at once be implanted beneath some part of the remaining capsule. Probably the greatest danger is in operating upon both lobes at the same time or the second lobe at a later period. Furthermore, it should be borne in mind that parathyroidal tissue is sometimes present within the thyroid gland. Although rare in the human, this important observation has been made by Müller, Getzowa, Michard, Kloeppel, and others, and is to be considered in the presence of tetany following removal of thyroïdal tissue, where the normal location of the parathyroids had been easily avoided. Beside the variability of the parathyroids in size, appearance, and location, another point of interest is to be kept in mind, namely, the observations of Vincent and Jolly on the relationship between parathyroidal and thyroïdal tissue. These investigators state that the thyroid and parathyroids are morphologically and functionally related; that the parathyroids left behind after thyroïdectomy can, under conditions, develop in the direction of thyroïdal tissue, and that a functional replacement also takes place.

Assuming that relationship to exist, it is conceivable that in some cases manifestations, which are the sequelæ of parathyroidal disturbance, may follow operations upon the thyroid gland. On the other hand, considering the generally unstable metabolic equilibrium and the associated psychic disturbances of many patients suffering with hyperthyroidism, we should not be at first too greatly concerned over a post-operative tetanoid attack, since it is intelligible that such manifestations might be precipitated by operative procedure. A few such cases have been observed and considered probably hysteroidal in nature.

Treatment.—No reliable treatment for tetany is at present known, but the experimental works of MacCallum and Voegtlin, together with the clinical and histologic observations of Erdheim, Strada, Yanase, Habersfeld and others suggest certain principles to be followed. According to these investigations deficient parathyroidal tissue is the principal causal factor in the condition, and there seems to be a disturbance at least of the calcium metabolism. Consequently, the ideal treatment would be to compensate for this glandular deficiency by transplanting parathyroids from other individuals, feeding with animal glands, the use of serum or the extract of parathyroidal tissue. Unfortunately none of these procedures has given dependable results. In order to restore the balance in calcium metabolism, calcium salts, acetate or lactate, should be administered either intravenously, subcutaneously, by stomach, or by rectal enemata, the strength of dose varying with the mode of administration.

In order to avoid those factors which contribute to the attacks of increasing the toxic metabolic product, the patient's general condition, especially the gastro-intestinal tract, should be given most careful attention, to show that such condition is relatively uncommon following operation.

In 3203 operations on the thyroid gland in St. Mary's Hospital, the total number up to December 1, 1911, but one patient is known by us to have manifested signs suggestive of tetany, yet when such signs do appear we cannot but feel that the condition is due to some error in operative technic.

CASE I.—G. H. S., female, aged forty-five years. Consultation Aug. 2, 1911. Clinical diagnosis, simple goitre. Family history, one sister had goitre. Personal history, two operations for lacerated perineum, last one eleven years ago. Sciatica, right leg, five years ago. Right lobe of thyroid gland enlarged for 25 years, left lobe for twelve years. Growing more rapidly the past three months, during which time the patient became nervous and suffered from dyspnœa. Rather despondent for last six months. No œdema. Able to do regular work up to present time. Operation, August 11, 1911 (St. Mary's Hospital), partial thyroidectomy, enucleation of cysts. Pathologic diagnosis, adenomata; cystic degeneration. Post-operative course: August 12, 1911, patient complained of stiffness in fingers and face, and tingling in legs. Fingers rigid and partially flexed at metacarpophalangeal joints, thumbs in palms; toes also flexed. August 13, 1911, patient complained of decided increase of symptoms. Treatment: 2.0 Gm. calcium lactate subcutaneously; thyroid extract, 0.30 Gm. every four hours for three doses; calcium lactate, 0.60 Gm. by mouth t.i.d. during the remaining time in hospital; trional, 0.60 Gm. at night. August 14, 1911, rigidity less and gradually diminished until the sixth day after operation, when it disappeared entirely. August 19, 1911, patient discharged from hospital.

It is questionable whether in this case genuine tetany was present, since some of the diagnostic points were wanting. The fact that symptoms subsided so soon after treatment might be suggestive, but a deduction from such unreliable premises would lead to error, especially since the signs did not reappear, and thyroid instead of parathyroid extract was used. Experimental evidence shows that, whereas tetany is relieved by the administration of calcium salts, yet the attacks tend to recur after 24 hours. Extract of thyroid gland was administered, but the indication for its employment is not supported by scientific investigation other than that the functions of the parathyroid and the thyroid seem to be inter-related. Even parathyroid extract has failed to produce effects in some cases of undoubted tetany (parathyroids removed at operation), although the treatment was continued for months.

Adhering closely to the view of parathyroidal causality in tetany, if the above was a genuine attack, either the parathyroids were already hypoplastic and rendered temporarily insufficient by the operative procedure and post-operative disturbances, or they were injured during operation, in which case an unusual location must be assumed, since only partial thyroidectomy and enucleation was performed on the thyroid gland of this patient. Finally, when the increasing nervous condition of the patient during the past several months is considered, the possibility of the manifestations having been hysteroidal in nature should be kept in mind.

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ARTERIOVENOUS ANASTOMOSIS—REVERSAL OF THE CIRCULATION—AS A PREVENTIVE OF GANGRENE OF THE EXTREMITIES.

REVIEW OF THE LITERATURE AND REPORT OF SIX ADDITIONAL CASES.

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A DISCUSSION has arisen of late between Coenen of Breslau and Wieting of Constantinople as to the efficacy of an arteriovenous anastomosis—reversal of the circulation—in preventing the spread of a real or threatened gangrene in the extremity of a human. Coenen claims that Carrel's statements and experiments in regard to the possibility of reversing the circulation in the limb of a dog are not conclusive. That, in fact, the valves of the veins do not give way as asserted and that as a result a true and complete reversal is never attained, the blood simply being shunted off to another vein and promptly returned to the heart without ever getting to the foot or hand. Furthermore, he asserts that the procedure is both anatomically and physiologically wrong, and he therefore warns against the indiscriminate performance of this operation.¹

Wieting on the other hand says that his clinical work, which has been highly successful, speaks for itself.² He admits that there are several questions, such as the return of the blood to the heart, still unsettled, but believes they will be solved only through clinical experience, theories and experimental work not having given the required solution.

¹H. Coenen and Wiewiorowski: Ueber das Problem der Umkehr des Blutstromes und die Wietingsche Operation, *Beit. z. klin. Chir.*, Aug., lxxv, Nos. 1-2, pp. 1-473, also *Cent. f. Chir.*, No. 29, 1911.

²Wieting: Treatment of Angiosclerotic Gangrene by Diverting Arterial Blood into Venous System, *Deut. Zeit. f. Chir.*, cx, Nos. 4-6, pp. 313-634.

In view of the increasing number of successful reversals, it would seem that Wieting's stand-point is deserving of some support. Indeed, it would be a sad state of affairs if, after all the brilliant experimental work done in the field of vascular surgery, we should still hesitate to attempt the practical application of our knowledge.

A careful search of the literature has revealed forty-six cases of arteriovenous anastomosis—reversal of the circulation—in the human, to which I wish to add the following six cases, two of which were done on the same individual, though at different times.

CASE I.—H. L., colored, male, age twenty-seven. (From the wards of Dr. W. S. Halsted, the Johns Hopkins Hospital.) This patient came in complaining of a growth in the right popliteal space. At operation, January 21, 1910, by Dr. Halsted, the growth was found to be a sarcoma originating in the popliteal nerve and involving the popliteal artery and vein. A defect of about four inches between the ends of the vessels remained after radical extirpation of the tumor. Believing then that the lower leg was in danger, I was graciously allowed to remove about five inches of the left saphenous vein and transplant it between the severed ends of the right popliteal artery and vein; in other words doing a typical reversal. (The distal end of the artery was so small that it was thought best to use the vein as its lumen more nearly corresponded in size with that of the saphenous transplant.) Following operation there was an oedema of the lower leg, a dilatation of the superficial veins, and an elevation of temperature in the right leg as compared to the left. The leg continued to have a good circulation, and the patient left the hospital in good shape and able to walk. He died 18 months after operation. No autopsy was obtained, as death occurred at his home, but the probabilities are that the growth returned.

According to E. Wolff,² out of thirty cases of popliteal aneurism, gangrene in various degrees occurred in fourteen

²Die Handförm der Extremitätennekrose nach Unterbindung grosser Gefässstämme. Beitr. z. Klin. Chir., No. 58, 1908, p. 737-763.

following extirpation. It is necessary therefore to consider this a doubtful case, inasmuch as the chances were about even, that the leg would have lived had no transplantation been done.

CASE II.—Miss M. G., white, age twenty-seven. Diagnosis Raynaud's disease. (Patient of Dr. J. C. Bloodgood, St. Agnes Hospital.) Five years ago the patient had a general infection from a wound on the index-finger. In May, 1910, she began to have pain in both feet, followed by some discoloration of the second toe of the right foot, necessitating removal of the toe. In January, 1911, two toes of her left foot became gangrenous and were removed. She constantly had pain in her legs, and her feet were always cold. On examination the pulse in the dorsalis pedis artery and the popliteal artery could not be felt in the left leg. The pain in this case was so severe and so constant that, believing the poor circulation had something to do with the condition, a reversal of the circulation in this leg was decided upon in the hope of giving relief. An end-to-end anastomosis between the femoral artery and vein in Scarpa's triangle was done on February 27, 1911. This being our first typical case, we made the mistake of cutting the vessels, vein, and artery at the same level and not allowing for the usual retraction following section of any vessel. It was not exactly a mistake either, because we started out to do a complete reversal, that is unite artery to vein and vein to artery, the latter to take care of the back flow. We did not know at that time, as we do now, that the complete reversal is all but impossible in the human without transplanting a piece of vein between one or the other of the vessels; nor did we know then, as we do now, that the complete reversal is unnecessary, because there are always enough veins in the limb to care for the back flow.

After trying for some time to bring the artery and vein together in spite of the retraction, we took about one inch off the upper end of the vein and transplanted it between the proximal end of the artery and the distal end of the vein, making a very satisfactory anastomosis. Following operation the pain gradually disappeared and now the left leg is apparently as good as it ever was. There is a powerful thrill to be felt and auscultated over the site of anastomosis and extending down to the knee.

For a time following this operation, strange to say, the patient obtained considerable relief in her right leg, and the dorsalis pedis and popliteal pulse, previously absent, could be obtained again. Gradually, however, the old pain recurred, the pulse was lost, and the foot began to get discolored in patches. The sciatic nerve was stretched, but only seemed to aggravate matters, in addition to giving the patient a foot-drop.

CASE V.—On May 27, 1911, therefore (10 days after stretching the sciatic nerve), a lateral anastomosis between the femoral artery and vein of the right leg according to the method of Bernheim and Stone,⁴ was done, the vessels being exposed and sutured in Scarpa's triangle. The vein was tied off proximal to the site of suture to prevent back flow to the heart, but the artery was left intact. We considered this an improvement over the old end-to-end anastomosis, because it did not disturb the arterial circulation at all, but simply gave an added channel of arterial blood by means of the vein. The anastomosis has been perfectly satisfactory, as is evidenced by the thrill and pulsation over the site of anastomosis and the splendid circulation of the foot.

At this date, 11 months after the first and 7 months after the second operation, the left leg has a circulation apparently as good as normal and gives no pain. The right leg also has an apparently normal circulation, but there is still a foot-drop, anæsthesia of the muscles of the lower leg, and pain along the course of the sciatic nerve. This condition is slowly improving, and strong hopes of a complete recovery are held out by the neurologists.

CASE III.—M. R., white, male, age forty. (Patient of Dr. J. C. Bloodgood, St. Agnes Hospital.) Patient had been a sufferer from Raynaud's disease for nearly five years, having suffered extreme pain at times in all his extremities. The circulation in his right toes was very poor, and they became gangrenous, one by one, until all but the big toe had to be removed. He seemed to get along fairly well as regards his left foot, until March, 1911, when he came in with beginning moist gangrene of all the toes of this foot. The arterial tension was not increased. The urine was negative; the Wassermann was negative.

The usual remedies failed to check the gangrene or to relieve the pain, so it was decided to reverse the circulation in the limb as a last resort. The operation was done March 27, 1911, an end-to-end anastomosis being done between the femoral artery and vein in Scarpa's triangle. The artery seemed smaller than normal, even when distended with blood, and the fibrous sheath as well as the adventitia was more adherent and perhaps a little more dense than usual. The calibre of the vein was smaller than usual, though in other respects it seemed normal.

On the day following operation, the leg was quite œdematous, all the superficial veins were dilated, a popliteal pulse could be felt (it was absent before operation), and the patient seemed to have less pain, although the condition of the foot had changed little, if at all. After this, the pain gradually became worse and the gangrene progressed, so that three days after operation the leg was amputated at the thigh. At this operation the site of the blood-vessel anastomosis was exposed and found to be working beautifully.

Looking backward, it would seem that this case was badly selected and the blood-vessel operation ought never to have been done, because apparently the gangrenous process had progressed so far that the nerves had become involved as well as the smaller vessels, thus making an attempt at saving the limb utterly hopeless.

CASE IV.—M. B., white, female, age sixty-one. (Patient of Dr. J. C. Bloodgood, St. Agnes Hospital.) This patient came in complaining of sharp pains and an extensive ulcer of her right foot, which had been present for about two and a half months. There was tingling and numbness, the skin was white and cold, and there were dark brown areas of gangrene from the toes to the ankle. The patient had a general arteriosclerosis, there was no sugar in the urine.

On March 27, 1911, the femoral artery and vein were exposed in Scarpa's triangle; on severing the artery preparatory to doing an end-to-end anastomosis, the vessel was found to be two-thirds occluded by an old thrombus; the vessel wall was quite thick and sclerotic. Although the outlook under such circumstances was very discouraging, the thrombus was pressed out of the vessel with the thumb and fore-finger and the usual

end-to-end anastomosis done. The blood went over in the usual manner and continued to do so as long as the vessels were exposed. Following operation, although no pulse could be felt over the site of anastomosis and no thrill could be elicited by the stethoscope, the condition of the patient's foot gradually became better and the ulcers healed. Just before the patient left the hospital a faint pulse could be felt in the femoral vein below the site of anastomosis. The success of this case from an operative stand-point is naturally doubtful, but the circulation in the patient's foot and leg was so poor before operation that it seems that had the anastomosis been a complete failure, the foot must surely have become gangrenous.

CASE VI.—W. L. B., white, male, age fifty-two. (Patient of Dr. J. M. T. Finney, at the Union Protestant Infirmary.) For about two years the patient had been suffering with severe pain in his left hand and arm, the fingers at times becoming quite cyanosed. He had had the tips of three fingers of this hand amputated because of gangrene. The other extremities were involved in a similar manner, but to a lesser degree, although the pain was so severe that the patient had become addicted to morphine. The patient had had a suspicious venereal sore and had been a heavy drinker; he had also had at one time, in 1900, a severe case of dysentery. There was a generalized arteriosclerosis; the urine was negative, the Wassermann was negative; no radial pulse was to be felt in the left wrist.

Under expectant treatment the patient improved for a time, but later on the condition in the left hand became so threatening that a reversal of the circulation in the upper arm was done in the hope of avoiding amputation. The operation was done on June 7, 1911. It had been our intention to do a lateral anastomosis, but on exposing the vessels the artery was found almost completely occluded by an organized thrombus. We therefore went above this thrombus and did an end-to-end anastomosis between artery and vein at the lower limit of the axilla. Following operation the patient's pain was completely relieved, the color in the arm and hand became far better than before operation, and motion in the fingers was considerably improved. No pulse, however, could be felt below the site of

anastomosis, and the success of this operation from an operative stand-point is also in doubt. It is fair to state, however, that the vein branched immediately below the suture line and thus divided up the pulse considerably. In addition to this, the patient left the hospital in such good condition that it seems as if some blood must have been going down to the hand through the venous channels, otherwise gangrene must have ensued.

A list, then, of all the cases in the literature, including my own, will be as follows:

CASES OF ARTERIOVENOUS ANASTOMOSIS REPORTED IN LITERATURE.

Case 1.—San Martin y. Satrustegui: Male, 52; situation leg, for gangrene of foot; lateral anastomosis. Failure; amputation 6 days post-operation, death 13 days post-operation.

Case 2.—San Martin y. Satrustegui: Male, 75; situation leg, for gangrene of foot; lateral anastomosis. Patient recovered, although before operation gangrenous part removed. Case negative.

Case 3.—Jaboulay: Male, 47; situation leg, for beginning gangrene; lateral anastomosis. Failure.

Case 4.—Jaboulay: Male, 67; situation leg, for threatened gangrene. Failure; amputation 4 days post-operation, death 6 days post-operation.

Case 5.—J. C. Hubbard: Male, 80; situation right leg, for beginning gangrene; artery invaginated into vein. Unimproved; amputation.

Case 6.—H. Lilienthal: Male, 20; situation left leg, for beginning gangrene; end-to-end. Death 31 hours after operation, shock.

Case 7.—C. A. Ballance: Female, 75; situation right leg, for beginning gangrene. Successful; patient died 5 months after operation of gangrene of the large intestine. No autopsy.

Case 8.—Wieting: Male, 40; situation left leg, for threatened gangrene; intubation. Successful; patient discharged after 2 months, well.

Case 9.—Orhan: situation leg, for beginning gangrene; intubation of popliteal artery and vein. Failure; amputation.

Case 10.—J. C. Hubbard: Female, 60; situation leg, for beginning gangrene; artery invaginated into vein. Failure; amputation.

Case 11.—F. B. Lund: Male, 32; situation left leg, for threatened gangrene; end-to-end. Failure; amputation.

Case 12.—J. C. Hubbard: Female, 84; situation left leg, for beginning gangrene; end-to-end. Failure; death from senility 2 months after operation.

Case 13.—D. J. Armour and E. A. Smith: Male, 69; situation right leg, for threatened gangrene; end-to-end. Failure; amputation 2 weeks post-operation.

Case 14.—J. C. Hubbard: Male, colored, 77; situation right leg, for beginning gangrene; end-to-end. Temporarily successful; amputation 5 weeks post-operation because of pain and œdema.

Case 15.—G. P. Muller: Male, 51; situation left leg, for beginning gangrene; end-to-end. Failure.

Case 16.—Bier: Male, 38; situation leg, for beginning gangrene; intubation. Failure; amputation.

Case 17.—Payr: Male, 70; situation leg, for beginning gangrene; intubation; profunda artery intubated into femoral vein. Failure; death 16 days post-operation.

Case 18.—Abalos: Male, 62; situation right leg, for beginning gangrene; lateral anastomosis femoral artery and saphenous vein. Failure; amputation.

Case 19.—Imbert: Male, situation leg, for gangrene; lateral anastomosis, femoral artery and saphenous vein. Failure; death 2 days post-operation.

Case 20.—Celesia: Female, 52; situation leg, for gangrene; lateral anastomosis, femoral artery and vein. Failure; death 20 days.

Case 21.—Goldberg: Male, 64; situation leg, for gangrene; intubation. Successful, but death 15 days post-operation from erysipelas.

Case 22.—Jaboulay: Male, 66; situation leg, for gangrene; end-to-end. Failure; amputation.

Case 23.—Tuffier: Male, 50; situation leg, for threatened gangrene; end-to-end. Successful.

Case 24.—Imbert: Male, 25; situation leg, for popliteal artery and vein ruptured by lightning stroke; end-to-end anastomosis of popliteal artery and vein. Failure; amputation.

Case 25.—Tuffier: Male, 56; situation left leg, for beginning gangrene; lateral anastomosis. Failure; death.

Case 26.—Doberauer: Male; situation arm, for thrombus and threatened gangrene; invagination. Successful.

Case 27.—Tuffier: Male, 50; situation leg, for beginning gangrene; end-to-end. Successful.

Case 28.—Lacroix: Male, 25; situation leg, for gun-shot wound; end-to-end. Failure; amputation.

Case 29.—Schmeiden: Female, 48; left leg, for gangrene; end-to-end. Death 24 hours post-operation.

Case 30.—Enderlen: Situation leg, for threatened gangrene; end-to-end. Failure; amputation.

Case 31.—Enderlen: situation leg, for beginning gangrene; end-to-end. Death 3 days post-operation.

Case 32.—Goyannes: situation leg, for aneurism; end-to-end. Successful.

Case 33.—Kruger: Female, 48; situation right leg, for beginning gangrene; intubation. Failure; amputation.

Case 34.—Tietze: Female, 69; situation leg, for gangrene; intubation. Failure; death 19 days post-operation.

Case 35.—Tietze: Male, 64; situation right leg, for gangrene; intubation. Successful, but death from erysipelas 15 days post-operation.

Case 36.—Payr: Male, 70; situation leg, for beginning gangrene; profunda artery intubated into femoral vein. Failure; death 16 days post-operation.

Case 37.—C. Beck: Male, colored; situation right leg, for gangrene; lateral anastomosis. Failure; amputation.

Case 38.—Wieting: Male, 40; situation right leg, for threatened gangrene; lateral anastomosis. Successful.

Case 39.—Orhan: Male, 40; situation left leg, for gangrene; intubation. Failure; amputation.

Case 40.—Wieting: Male, 33; situation left leg, for beginning gangrene; lateral anastomosis. Temporarily successful; amputation 3 months post-operation.

Case 41.—Wieting: Male, 35; situation right leg, for threatened gangrene; intubation. Successful; although half of foot had to be amputated.

Case 42.—Wieting: Male, 32; situation left leg, for threatened gangrene; lateral anastomosis. Successful.

Case 43.—E. Heymann: Male, 47; situation left arm, for beginning gangrene; end-to-end. Successful; patient well 11 months post-operation.

Case 44.—Quenu: Male, 48; situation left leg, for Raynaud's disease; end-to-end. Temporarily successful; amputation 4 months post-operation.

Case 45.—Coenen: Male, 51; situation right leg, for beginning gangrene; end-to-end. Failure; amputation 4 days post-operation.

Case 46.—Glasstein: Male, 38; situation right leg, for threatened gangrene; end-to-end. Successful.

Case 47.—B. M. Bernheim: Male, colored, 27; situation right leg, for sarcoma of popliteal space necessitating resection of popliteal vessels; end-to-end. Doubtful; death from metastases 18 months post-operation.

Case 48.—B. M. Bernheim: Female, 27; situation left leg, for Raynaud's disease; end-to-end. Successful.

Case 49.—B. M. Bernheim: Female, 27; situation right leg, for Raynaud's disease; lateral anastomosis. Successful.

Case 50.—B. M. Bernheim: Female, 61; situation right leg, for beginning gangrene; end-to-end. Successful.

Case 51.—B. M. Bernheim: Male, 40; situation right leg, for Raynaud's disease; end-to-end. Failure; amputation 3 days post-operation.

Case 52.—B. M. Bernheim: Male, 52; situation left arm, for threatened gangrene; end-to-end. Successful.

In studying these 52 cases I find that 38 were done on males, 10 on females, and in 4 the sex was not stated. The ages varied all the way from 20 to 80 years. Fifteen out of the 52 cases must be considered successful ones, that is, cases in which the reversal, as far as one can judge, actually saved the limb from real or threatened gangrene—a percentage of 30 per cent. I have included Case 7 among the successes, because death was in no way related to the vascular condition in

the leg, but I have thrown out Cases 14, 40, and 44 because, though apparently successful as far as the actual operation was concerned, an amputation later on became necessary. Case 47, as said above, I consider doubtful, and Case 2 negative.

Among the failures there were 13 deaths; 2 from shock and 11 from senility and erysipelas. Most of these patients were in a desperate condition physically at the time of operation, thus rendering an operative procedure precarious to say the least.⁵ It is difficult to see how the operation of reversal of the circulation could have contributed any more to the cause of death than any other operative procedure that may have been performed on the limbs of the same individuals. Just why there should have been so many cases of erysipelas is a mystery to me, unless it can be laid to the door of faulty technic. It has not occurred in my own series of cases.⁶

In the remaining 22 cases the course of disease was uninfluenced by the reversal, although there was a temporary improvement in several cases. Amputation was performed in each instance.

The operation was done twice in the upper extremity, once for thrombus and threatened gangrene, once for threatened gangrene, both times successfully. The remaining cases were in the leg, the operation being done four times for Raynaud's disease, once for sarcoma of the popliteal space, which necessitated removal of about four inches of the popliteal artery and vein, once for aneurism, once for rupture of the popliteal artery and vein, once for gun-shot wound, and the remainder for real or threatened gangrene.

As to methods of operation, the end-to-end suture of Carrel and Stich was done 23 times with 8 successes, lateral anastomosis 12 times with 4 successes, invagination (end of artery into end of vein) twice with 1 success, and the intuba-

⁵ In a personal communication to Coenen, Gottstein said that he had done three cases of reversal, with death in each case.

⁶ It is interesting to note that in the last 16 cases there have been no deaths, and that of these cases 9 were successful, 5 unsuccessful, and 1 doubtful.

tion of Wieting (end of artery into side of vein) 9 times with 2 successes. The method was not stated twice and one of these operations was successful.

I believe, and Wieting also seems to lean toward a similar belief, that in the future the method of choice for reversal will be a lateral anastomosis, and in conjunction with Stone⁷ have advocated a method whereby the artery and vein are incised transversely through one-third of their diameter and then sutured. Following the suture and before turning on the blood stream, the vein is tied off proximal to the site of anastomosis to prevent back flow to the heart. The flow through the artery is not interfered with whatsoever, the only thing that happens being an added arterial channel through the vein. In this way the artery will continue to carry nourishment as far as it is patent, while the vein will supposedly carry it to the foot or hand. Should a thrombus occur at the site of anastomosis, it will form in the side of the artery (as we have proved experimentally) and the limb will be no worse off than before. On the other hand, in the event of success, the limb will have an abundant supply of blood. I have so far done this operation once clinically (Case 49), and have been very much gratified at its success. Wieting did a somewhat similar operation in Cases 38, 40, and 42, the first and last being successful.

Just how far down the vein the blood will go is a question that can be decided only by clinical cases. That the arterial pressure will force the blood beyond the valves of the femoral vein in a dog I have demonstrated experimentally, as well as Carrel, and I am firmly convinced that a similar phenomenon takes place in the human. To say that Wiewieorowski was unable to inject the veins of a cadaver from above and that, therefore, a reversal of the circulation in a limb is impossible, shows a lack of understanding of conditions as they are in the living.⁸ The constant pounding of the arterial blood

⁷ ANNALS OF SURGERY, October, 1911.

⁸ Coenen and Wiewieorowski have only done one case in the human and that was unsuccessful.

against the valves of the vein gradually wears them down and forces them to give in the dog; why cannot a similar condition take place in the human? I believe it does, just as the constant pounding of the surf wears down the hardest rock, just as the fearful pounding of a thoracic aneurism at times slowly but surely wears away a man's vertebræ.

But as Wieting says, success is the best of all refutations, and as time goes on the successful cases will increase in number. In the past, the cases have not been selected with sufficient care. It is obviously impossible to bring the dead back to life, yet that has all but been attempted. Around every fulminating gangrenous area the neighboring vessels, veins as well as arteries, are partially or wholly thrombosed. If this condition prevails only to a slight degree, well and good, but if it is extensive, if all the toes, or half the foot, or all the foot is involved, to do a reversal is only inviting failure. The cases must be gotten before the gangrene arises. If this is impossible, it is best to let the process subside or localize and then do a reversal in the hope of preventing further encroachments. The age of the patient has little or nothing to do with the question, but rather the age and condition of his vessels.

Another most important factor to be considered is the skill and experience of the operator. It is my belief that the frequent failure following reversal of the circulation in the past has been due not so much to the failure of the valves of the veins to give way as to a thrombus at the site of anastomosis—in other words, to a faulty technic in the suture. Animal experimentation and lots of it is an absolute necessity to the surgeon who wishes to do clinical work in the field of vascular surgery. Too much stress cannot be laid upon this point, and a more general observance of it can but bring better results.

It is indeed a great pleasure to be able to acknowledge my indebtedness to Dr. W. S. Halsted, Dr. J. M. T. Finney, Dr. J. C. Bloodgood, and Dr. Harvey Cushing. Without their aid and kindly sympathy neither the experimental nor the clinical work which forms the basis of this paper could have been accomplished.

the very men who should be competent to suture blood-vessels. Any effort to simplify the technic should therefore increase the clinical usefulness of this procedure. In experimental work, after the general principles are mastered, such as placing the sutures and careful handling of the intima, the most prominent difficulty is managing the guy sutures. The necessity for changing hands and transferring guy sutures after suturing each third of the vessel, the chances of their being tangled, the maintenance of proper tension on the guy sutures, and the relaxation of the tension while changing from one-third of the vessel to the other, are likely to be confusing and to make the sutures irregular and faulty. Another very practical objection is the difficulty in obtaining the services of an assistant trained in this work at just the time when such help is most needed.

In order to avoid these difficulties and in an effort to simplify the technic, I have used an instrument for holding the guy sutures in position. This instrument (Fig. 1) consists of a small steel shaft about one-sixteenth of an inch in diameter, which curves at one extremity into a shorter shaft. The long shaft or handle is six inches long, and the short shaft is one and three-quarter inches long. The short shaft is placed at an angle of 55 degrees to the long shaft. The curved portion is flattened out quite thin so as to form a light spring. There are five buttons, one on the main shaft as close as possible to the curve, one at the extremity of the short shaft, one a half inch below this, and two on the main shaft at points about opposite the buttons on the short shaft. All of these buttons hug the instrument closely and are so constructed that the guy sutures are held securely by merely wrapping them twice around the buttons.

The technic of suturing blood-vessels with the use of this instrument is as follows:

The vessel is exposed and clamped on each side of the operative field with rubber covered Crile clamps. It is divided with sharp scissors, and the adventitia is pulled down over each end of the vessel between the finger and thumb and cut squarely off.

NOTES ON THE TECHNIC OF SUTURING BLOOD- VESSELS WITH A NEW INSTRUMENT.*

BY J. SHELTON HORSLEY, M.D.,

OF RICHMOND, VIRGINIA

THE history of successful blood-vessel suturing goes back only a few years. In no department of surgery is success so dependent upon an accurate following of technical detail. The slightest break in asepsis, any undue roughness in handling the vessels, or the lack of mechanical accuracy means either immediate failure or else clotting and obstruction of the lumen of the vessel soon after the operation has been completed. The development of this distinctive branch of surgery has been fully described by Watts,¹ and more recently by Ehrenfried and Boothby,² and Winthrop.³ Carrel's work in demonstrating, in 1902, the essential features in suturing blood-vessels is the real beginning of successful surgery in this field. He showed that strict asepsis, the utmost gentleness in handling the vascular endothelium, and accurate approximation of intima to intima are prime factors in suturing blood-vessels. He called attention to the fact that, aside from immediate failure, remote clotting was due to some technical error, as wherever the endothelial cells of the intima are injured, either by trauma or by drying, clots sooner or later are very likely to occur.

It is the general opinion among surgeons that the suturing of blood-vessels is exceedingly delicate and may be done only by a favored few. In this way its usefulness has been curtailed. For emergency surgery, such as stab and bullet wounds of the vessels, furnishes the most fertile clinical field for this work, and those who do much emergency surgery are

* Read by title at a meeting of the Southern Surgical and Gynecological Association, Washington, D. C., Dec. 12, 13, and 14, 1911.

¹ Bulletin of Johns Hopkins Hospital, 1907, vol. xviii.

² ANNALS OF SURGERY, Oct., 1911, 485.

³ Southern Medical Journal, Nov., 1911, 760.

the very men who should be competent to suture blood-vessels. Any effort to simplify the technic should therefore increase the clinical usefulness of this procedure. In experimental work, after the general principles are mastered, such as placing the sutures and careful handling of the intima, the most prominent difficulty is managing the guy sutures. The necessity for changing hands and transferring guy sutures after suturing each third of the vessel, the chances of their being tangled, the maintenance of proper tension on the guy sutures, and the relaxation of the tension while changing from one-third of the vessel to the other, are likely to be confusing and to make the sutures irregular and faulty. Another very practical objection is the difficulty in obtaining the services of an assistant trained in this work at just the time when such help is most needed.

In order to avoid these difficulties and in an effort to simplify the technic, I have used an instrument for holding the guy sutures in position. This instrument (Fig. 1) consists of a small steel shaft about one-sixteenth of an inch in diameter, which curves at one extremity into a shorter shaft. The long shaft or handle is six inches long, and the short shaft is one and three-quarter inches long. The short shaft is placed at an angle of 55 degrees to the long shaft. The curved portion is flattened out quite thin so as to form a light spring. There are five buttons, one on the main shaft as close as possible to the curve, one at the extremity of the short shaft, one a half inch below this, and two on the main shaft at points about opposite the buttons on the short shaft. All of these buttons hug the instrument closely and are so constructed that the guy sutures are held securely by merely wrapping them twice around the buttons.

The technic of suturing blood-vessels with the use of this instrument is as follows:

The vessel is exposed and clamped on each side of the operative field with rubber covered Crile clamps. It is divided with sharp scissors, and the adventitia is pulled down over each end of the vessel between the finger and thumb and cut squarely off.

The ends are washed out with salt solution in a medicine dropper. The ends of the vessel are then smeared with warm vaseline and three guy sutures are placed with a No. 16 straight needle and fine black silk. I untwist No. 1 black Chinese twisted silk into three strands and use these for sutures. After threading, the strand is secured in the needle by a single knot. The thread must be thoroughly anointed with vaseline before being used or may be boiled in vaseline. Three guy sutures divide the vessel's circumference into three equal parts and are passed by going from without inward near the end of the vessel, the point of the needle emerging from the intima. The needle is then carried to the other end of the vessel, which it penetrates in a reverse direction, that is, from within out, entering on the intima. These guy sutures are tied as they are inserted, using the ordinary knot. The ends of the suture are held taut while running down the second turn of the knot so as to prevent the first turn from slipping. The instrument above described is then placed under the artery with the short shaft toward the operator, and the bottom guy suture is wrapped twice around the lowest button on the main shaft. The ends of the suture are then cut close to the button so as to be rid of unnecessary thread. The upper guy suture nearest the main shaft is fastened by taking the end of the suture without the needle (the short end of the suture) and wrapping it around one of the two upper buttons on the main shaft. In vessels of ordinary size the lower of these two buttons is used. The end of this suture that is threaded is not cut, but is left for future suturing. The third guy suture is wrapped twice around one of the buttons on the short shaft while this shaft is very slightly pressed toward the main shaft. When this pressure is released, tension is placed on the three guy sutures, and the circumference of the blood-vessel is pulled from a circle into a triangle and held rigidly in this position (Fig. 2). The suturing begins at the upper guy suture on the main shaft, that is, the upper guy suture farthest from the operator. The instrument is held with the handle vertical, and the long end of this guy suture, which has been left with the needle attached, is passed back and forth through the slightly everted lips of the upper third of the margins of the artery, after the manner of a continuous mattress suture (Fig. 3). The instrument is slightly elevated during this suturing, which still

FIG. 2

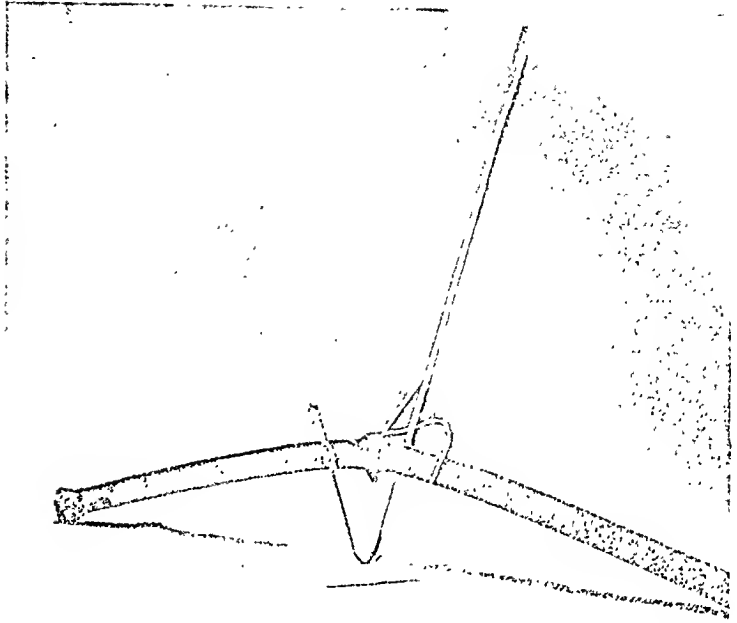


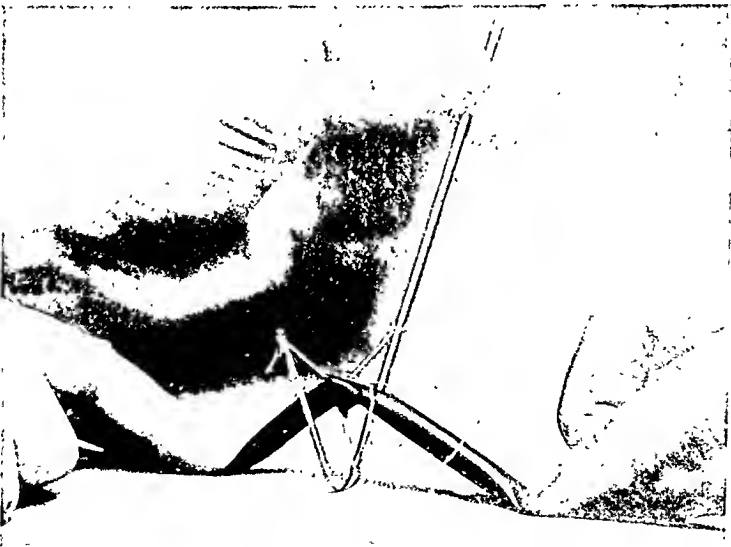
FIG. 1.



The instrument for holding the guy sutures, as described in the text.

A thin rubber tube representing an artery with the three guy sutures placed and fastened to the buttons on the instrument. The circumference of the tube is made triangular by the tension of the guy sutures.

FIG. 3.



The handle of the instrument is upright and the continuous mattress suture has been started.

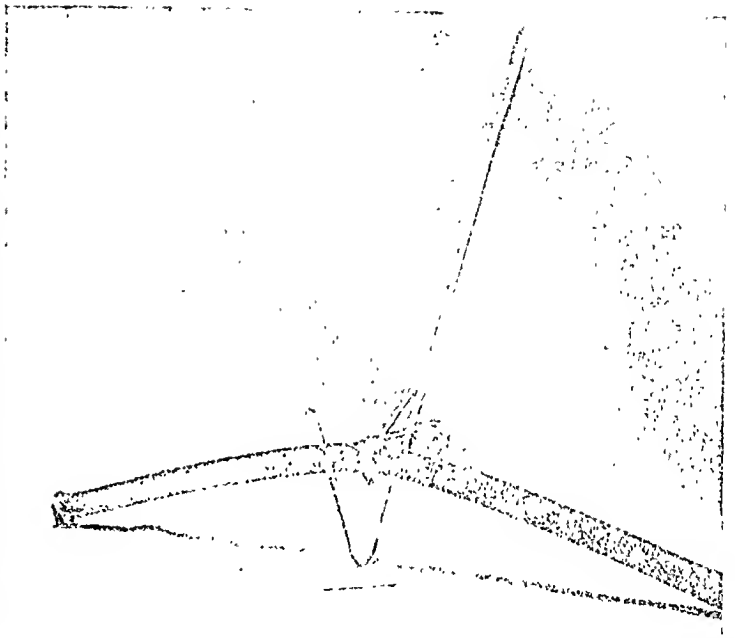
The ends are washed out with salt solution in a medicine dropper. The ends of the vessel are then smeared with warm vaseline and three guy sutures are placed with a No. 16 straight needle and fine black silk. I untwist No. 1 black Chinese twisted silk into three strands and use these for sutures. After threading, the strand is secured in the needle by a single knot. The thread must be thoroughly anointed with vaseline before being used or may be boiled in vaseline. Three guy sutures divide the vessel's circumference into three equal parts and are passed by going from without inward near the end of the vessel, the point of the needle emerging from the intima. The needle is then carried to the other end of the vessel, which it penetrates in a reverse direction, that is, from within out, entering on the intima. These guy sutures are tied as they are inserted, using the ordinary knot. The ends of the suture are held taut while running down the second turn of the knot so as to prevent the first turn from slipping. The instrument above described is then placed under the artery with the short shaft toward the operator, and the bottom guy suture is wrapped twice around the lowest button on the main shaft. The ends of the suture are then cut close to the button so as to be rid of unnecessary thread. The upper guy suture nearest the main shaft is fastened by taking the end of the suture without the needle (the short end of the suture) and wrapping it around one of the two upper buttons on the main shaft. In vessels of ordinary size the lower of these two buttons is used. The end of this suture that is threaded is not cut, but is left for future suturing. The third guy suture is wrapped twice around one of the buttons on the short shaft while this shaft is very slightly pressed toward the main shaft. When this pressure is released, tension is placed on the three guy sutures, and the circumference of the blood-vessel is pulled from a circle into a triangle and held rigidly in this position (Fig. 2). The suturing begins at the upper guy suture on the main shaft, that is, the upper guy suture farthest from the operator. The instrument is held with the handle vertical, and the long end of this guy suture, which has been left with the needle attached, is passed back and forth through the slightly everted lips of the upper third of the margins of the artery, after the manner of a continuous mattress suture (Fig. 3). The instrument is slightly elevated during this suturing, which still

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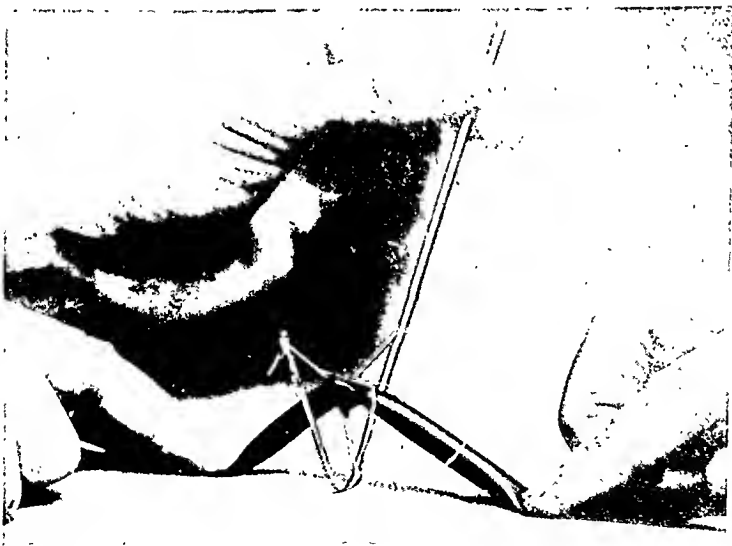
The instrument for holding the guy sutures, as described in the text.

FIG. 2



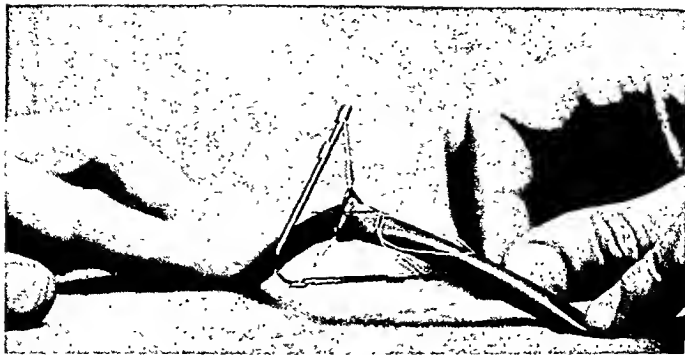
A thin rubber tube representing an artery with the three guy sutures placed and fastened to the buttons on the instrument. The circumference of the tube is made triangular by the tension of the guy sutures.

FIG. 3.



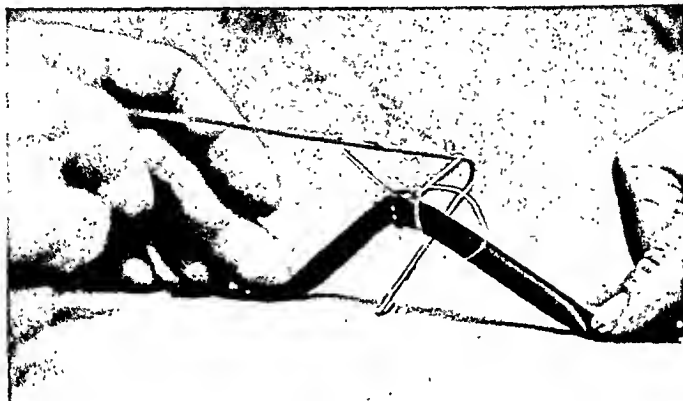
The handle of the instrument is upright and the continuous mattress suture has been started.

FIG. 4.



The handle is depressed till it is horizontal and points away from the operator. The second division is being sutured.

FIG. 5.



The handle of the instrument is depressed till it is horizontal—this time pointing toward the operator. The last division is being sutured.

FIG. 6.



The handle of the instrument has been brought to its original position and the suturing has been completed. The instrument is grasped between the thumb and fingers and compressed to relax tension of the guy sutures and demonstrate whether there is a spurting point along the suture line.

further increases the eversion of the margins of the vessel and renders it possible to place the sutures more accurately. The suturing is done toward the operator, and constant tension is kept on the suture by holding the thread in the left hand and so bringing the thread down snugly after each suture is placed with the right hand. The sutures are close together. In the carotid of a medium sized dog, there should be about five or six sutures between each guy suture.

When the second guy suture is reached, the handle of the instrument is depressed away from the operator till it lies horizontal (Fig. 4) instead of vertical. The whole instrument should then be slightly shoved toward the operator, so as to increase the eversion of the intima in the third that is being sutured. The suture is continued along the second third of the vessel's circumference in the same manner as in the first, only care must be taken to place the suture at the angle well inside of the guy suture, as the latter may cut the vessel somewhat and so cause leakage, and also because the vessel wall is pulled out more markedly at this point, which makes it necessary to take a deeper bite here in order to secure uniformity in the line of sutures.

When the third guy suture is reached the position of the instrument is again changed, the handle or main shaft being depressed toward the operator (Fig. 5). The position of the instrument now is such that the handle points to the operator while suturing the last third of the artery, which is exactly the opposite direction to its position while suturing the second third. The whole instrument is gently elevated to increase the eversion of the margins of the artery. The suture is continued along the last third of the artery, and when the starting point is reached the instrument is brought to its original vertical position.

The suture is carried about two stitches beyond the starting point, and is there finished by whipping it over twice after the manner of an over-hand suture, and running the thread under the loop before the loop is drawn tight. This holds the thread securely. The Crile clamps are then loosened gradually, the distal one first. The shafts of the instrument are grasped between the thumb and fingers and pressed toward each other so as to relax the tension on the guy sutures (Fig. 6). If any

spurting point occurs the clamps are reapplied, the pressure on the shafts is relaxed, and an extra suture is placed at the spurting point. This is rarely necessary in suturing arteries, though, where a segment of vein is grafted on an artery, a spurting point often occurs. If no point spurts, the guy sutures are cut close to the artery and the instrument is removed. The small amount of oozing immediately after the suturing is completed usually checks spontaneously, or at least after gentle pressure with dry gauze. If after slight pressure with dry gauze for a minute there is still any leakage of blood, a suture should be placed at the point of leakage. If too much pressure is made with gauze a clot may form. When the wound is closed the arterial suturing should be perfectly dry and free from any oozing of blood.

In discussing the advantages of this new method, let us first consider the merits of a continuous mattress suture in blood-vessel surgery. It is well known that in intestinal surgery the continuous mattress suture makes exceedingly smooth approximation on the peritoneal surface, and a minimum amount of thread is left exposed. In the case of a blood-vessel, the endothelial layer is on the inside of the vessel instead of on the outside, as in the intestine. The object in each instance is to approximate the endothelial surface, and by applying the continuous mattress suture, as recommended in the above technic, we obtain the same approximation and minimum exposure of the thread within the vessel as is seen on the serous surface of the bowel after the application of a continuous mattress or right angle suture. In blood-vessel suturing it is most desirable to have as little of the thread exposed to the current as possible, and this suture is more capable of fulfilling this requirement than any other continuous suture. In addition to this advantage, there is less likelihood of the vessel being cut with mattress stitches than with other forms of suture. This property of the mattress suture is recognized in general surgery and is utilized in sewing such tissue as muscles when cut transversely; where a single straight suture will cut out, the mattress suture, which grasps a loop of tissue at a right angle to the line of traction, will hold.

The advantages of the instrument have already been alluded to. Of course, to obtain satisfactory results it must be properly used. The guy sutures should be of about equal length from the buttons to the artery, so that no undue traction is made on any one suture. If the guy sutures are of equal length, the tension of all of them can be increased or diminished by regulating the suture that runs to the end of the short shaft. If the short shaft is pressed upon too forcibly when the last guy suture is applied, so much tension will be made that the guy sutures may cut the vessel wall unduly. This is very easily regulated, and when once the guy sutures are properly placed the tension all along the arterial wound remains exactly the same from the beginning to the end of the suturing. This insures uniformity of the sutures, and prevents the alternate stretching and relaxation that must occur every time the guy sutures are changed when they are held by hand. No skilled assistant is required, and in fact a blood-vessel can be sutured by the operator without any assistance at all, as he can hold this instrument in part of the left hand, while the thumb and index-finger of the same hand follow the thread as the sutures are placed. If a leak occurs it is easily demonstrated by loosening the clamps and relaxing the guy sutures by compressing the shafts of the instrument as described above (Fig. 6). The clamps are then reapplied and the leak accurately sutured with the vessel still held in the instrument. In this manner, any competent surgeon with some experience in experimental work on the arteries can confidently suture large vessels or perform transfusion of blood with a needle and thread. In both instances the same technic is used.

In transfusion of blood, where the artery of the donor is united to the vein of the patient, this method of suturing is particularly desirable. As pointed out elsewhere,⁴ it is best to select a vein where a branch is given off. This branch is clamped with a mosquito forceps and will serve as a gauge to show the rate of flow. In my own experience, the flow in

⁴ Journal A. M. A., Aug. 20, 1910.

transfusion is more likely to be unsatisfactory because of contraction of the exposed radial artery than on account of blockage at the site of anastomosis. Of course, this can be largely avoided by keeping the vessel covered with gauze saturated with warm salt solution. But it is necessary occasionally to inspect the vessels and, as a rule, the vessels are inspected oftener than is necessary and each exposure tends to increase the contraction. As the radial artery firmly contracts, it will almost shut off the flow of blood entirely. If this occurs when sutures are used for transfusion, a small probe can be passed through the venous branch, through the site of anastomosis, and up into the radial artery, thoroughly dilating it. The probe must be perfectly smooth, and should be anointed with vaseline before it is introduced; it must be withdrawn quickly, when it will be followed by a spurt of blood. The venous branch is then clamped as before, and the vessels surrounded with warm moist gauze. Such a procedure is impossible when a fixed cannula is used without the risk of seriously injuring the intima where the metal probe passes through the cannula. Suturing an artery or transfusion of blood can easily be done with this technic in ten to fifteen minutes after the vessels are exposed if the operator has had some experimental experience.

Suturing blood-vessels seems to be going through the same stage as intestinal suturing underwent fifteen years ago. At that time there were hosts of appliances of all shapes and descriptions for uniting severed intestines, but it was found that with a little practice, a needle and thread was superior to complicated buttons and bobbins, and these appliances have been generally abandoned. It is not improbable that history will repeat itself in the case of arterial suturing.

A NOTE ON THE DIVISION AND CIRCULAR SUTURE OF THE AORTA IN PREGNANT CATS.

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AND

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IN a recent article ¹ we described in detail our adaptation of the Carrel method of end-to-end anastomosis of blood-vessels, using the abdominal aorta of the cat. During our experimentation we have encountered three cats which were pregnant; as this is a complication hitherto unmentioned in blood-vessel surgery, we think these three protocols worthy of a separate record.

(1) March 17, 1910: Female cat etherized; cœliotomy revealed a uterus containing five fetuses; hysterectomy, excision of one-half inch of the abdominal aorta, reimplantation of the segment by circular suture. After re-establishing the circulation there was no pulsation of the artery distal to the segment; gentle stripping of the implanted artery caused obstruction to disappear and pulsation became visible and palpable.

March 22: Cat alive, but walking unsteadily, eating fairly well.

March 24: Apparently in excellent condition.

March 26: Ninth day; cat found dead; autopsy revealed a small amount of pus in abdominal wound but no peritonitis; aorta found patent, no thrombosis. Lungs showed an extensive bronchopneumonia.

(2) May 24, 1910: Female cat etherized; cœliotomy revealed a uterus containing five fetuses; uterus and intestines retracted under hot towels, aorta clamped, divided, and united with circular suture; uterus and intestines replaced, abdominal wound closed. (Circulation interrupted for fifteen minutes; entire operation occupied thirty-five minutes.)

June 1: Cat is making uneventful recovery from operation, and pregnancy is apparently progressing normally.

We are indebted to Prof. W. T. Porter for the use of the Laboratory of Comparative Physiology in the Harvard Medical School for our experimental work.

¹ Ehrenfried and Boothby: The Technic of Arterial Anastomosis. *ANNALS OF SURGERY*, 1911, liv, 485.

July 1: Cat is in best of health, active and strong, and is evidently approaching full term.

July 10: During the night the cat delivered herself; one perfectly formed and healthy kitten found with its mother but no trace of the other four fetuses or of after-birth (there were many cats in the same cage, and they were probably eaten).

(3) July 14, 1910: Female cat etherized; cœliotomy revealed a uterus containing five large fetuses; uterus and intestines retracted under hot towels, aorta clamped, divided, and united with circular suture; uterus and intestines replaced, abdominal wound closed.

July 28: Cat has made uneventful recovery from the operation, is perfectly healthy, and is evidently approaching full term.

August 4: Cat to-day observed to have delivered herself during the night, but no trace of fetuses or after-birth found. We presume they were eaten.

CONCLUSION.—It is possible to completely interrupt the circulation of the abdominal aorta in a pregnant cat for fifteen minutes, divide the aorta, perform a circular suture thereof, and re-establish the circulation without interfering with the course of the pregnancy.



OBSERVATIONS UPON A SERIES OF FORTY-THREE LAMINECTOMIES.

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FIRST PAPER.

AMONG 43 consecutive operations upon the spine¹ during the past two years, laminectomy for tumor was performed in 13 patients. Of the 13 cases, 9 were extramedullary and 4 were intramedullary growths. Of the extramedullary, the bone and muscles were involved in addition to the meninges in 2 patients, while in 7 the tumor was entirely intradural. Of the latter, 2 were in the dorsal or lumbar cord, 5 involved the conus and the roots of the cauda equina.

There were in all 36 primary laminectomies and 7 secondary operations. In addition to the 13 patients with spinal tumor, there was one with a collection of fluid (arachnoid cyst?). Posterior root section was done ten times; extirpation of diseased bone pressing on the cord twice; a peculiar disease of the posterior nerve-roots was encountered in one patient; two patients had an acute osteomyelitis of the vertebrae; one, a fracture dislocation; there were eight exploratory operations.

In the operative and post-operative treatment of the patients with spinal tumor, a number of observations were made which are recorded in what follows.

THE EXTRUSION OF INTRAMEDULLARY TUMORS OF THE CORD.

In all of the patients with intramedullary growths of the cord, the tumor was treated by the method of extrusion which has been recently described by myself and Dr. Beer.

¹The greater number of these operations were performed by the writer at the New York Neurological Institute, a few were done at Mt. Sinai Hospital, New York. Six patients were operated upon by Dr. E. Beer (section of posterior roots, 4 cases; intramedullary tumor, 1 case; removal of cauda tumor, 1 case).

If, upon exposure of the cord, the growth was found to be an intramedullary one, a small incision was made in one posterior column over the tumor a few millimetres from the median line. The operation was then concluded for the time being, and the muscles, fascia, and skin sutured in the usual manner. About one week later, the wound was reopened and the tumor was found more or less completely extruded from the cord substance, so that it could be removed with little injury to the cord tissue. The tumor usually appears much larger after its extrusion, because of the oedema of the extruded mass.

We have thus far, in the Neurological Institute, treated four cases of intramedullary tumor by the extrusion method. Three of the four cases have already been reported;² a synopsis of the history of the fourth patient follows:

Intramedullary glioma of the cord (first, second, third, fourth, cervical, and medulla); laminectomy and incision of cord; death from respiratory paralysis two days after operation.

D. C., laborer, thirty-seven years old, admitted to the Neurological Institute on the service of Dr. Fraenkel, on November 27, 1910. The patient gave a thirteen months' history of numbness in the left side of the face, neck, and upper extremity. Soon after the numbness the patient began to have some pain in the back of the neck, and at the same time the left upper extremity became weak. For six months before admission, increasing difficulty in walking; for three weeks, weakness in the right upper extremity. During the first few days' stay in the hospital, it was noted that the patient's pulse was weak and irregular at times.

The patient is a large, well-nourished man; he holds his neck rigid on account of the pain in the back of the neck. His gait is markedly spastic. Over the left side of the face, sensations of touch, pain, and temperature are much diminished. The left cornea is markedly hypæsthetic. There is a marked atrophy

² Elsberg and Beer: Amer. Jour. of the Med. Sciences, November, 1911.

³ Elsberg and Beer: loc. cit.

of the left trapezius, sternomastoid, serratus, deltoid, supraspinatus, and infraspinatus muscles. All of the reflexes on the left side of the body are exaggerated; ankle-clonus and Babinski on the left side. Wassermann and X-ray examinations negative. No relief of pain by immobilization of spine.

January 18: Laminectomy (Dr. Elsberg): Removal of spines and laminae of second, third, fourth, fifth, and sixth cervical vertebrae. Cervical cord found much enlarged. At the level of the third cervical segment a small cystic looking mass in the left posterior column. Aspiration negative. Small incision in posterior column 1 cm. in length, over the most prominent part of swelling; suture of muscles and skin.

For two days after the operation the patient did very well. On the third day he had several attacks of difficulty in breathing. On the evening of that day he suddenly stopped breathing. In spite of artificial respiration and active stimulation, the heart action became gradually poorer, until it ceased altogether.

The post-mortem examination showed that there was an intramedullary tumor which extended from the third cervical segment up through the cord into the medulla, where it had grown through the posterior surface of the medulla into the posterior fossa. The growth was an infiltrating glioma which had been slightly extruded through the incision in the posterior column, made at the operation. The field of operation was in perfect condition.

REMARKS.—The tumor was of such a size and in such a location that it was remarkable that the patient did not suffer from more marked medullary symptoms before the operation; it is certain that, in a short space of time, he would have died a sudden medullary death if no operation had been performed. No doubt the removal of the spines and laminae diminished the resistance or support below, and this, together with the gradual downward movement of the tumor in the process of extrusion through the incision in the posterior column of the cord, had caused a pressure upon the medulla in the foramen magnum and thus hastened the medullary death. Had I removed part of the margin of the foramen magnum at the operation (which could have been done with ease), the sud-

den death might have been delayed, and, if the condition had not been beyond surgical relief, perhaps prevented. The case, therefore, taught us a valuable lesson. In operations for spinal tumors which extend high up on the cervical cord, it is advisable to remove part of the margin of the foramen magnum so as to prevent undue pressure upon the medulla by the extruding tumor (if medullary) or through a secondary œdema of the parts after the operation.

The Value of Extrusion in the Removal of Tumors of the Cauda Equina.—In three of four cases of large tumors surrounding the roots of the cauda equina, I have treated the tumors by extrusion with satisfaction. The amount of injury done to the nerve-roots is much diminished by this method, as the histories of the following cases demonstrate. All of the patients were suffering from extensive endothelioma or endothelial sarcoma.⁴

CASE I.—*Metastatic Sarcoma Surrounding the Roots of the Cauda Equina; Laminectomy and Removal; Death after Two Months.* M. S., forty-two years old, was admitted to the service of Dr. Collins at the Neurological Institute. Two years' history of pain, beginning in the back of the right thigh and in the small of the back. Urinary incontinence and impotence for nine months, stiffness of both lower extremities; numbness and sensations of cold in both feet. Symptoms steadily progressive.

Abdominal reflexes normal, cremasterics cannot be obtained; both lower limbs spastic and ataxic; absent knee- and ankle-jerks. Sensory disturbances over the distribution of the second, third, fourth lumbar and first to fourth sacral roots. Tenderness on percussion over first and second lumbar spines.

January 27, 1910: Laminectomy (Dr. Elsberg) twelfth dorsal, first, second, and third lumbar. Incision of dura revealed large reddish-brown tumor surrounding the lower part of the conus and the roots of the cauda equina. After a prolonged and tedious dissection, during the course of which several nerve-roots had to be divided, the tumor was freed from the nerve-

⁴This is a class of cases which have not been adequately described. They present a very characteristic clinical picture. These cases will be described in detail in a paper by Dr. Collins and the writer.

roots and removed. It was only slightly adherent to the dura, but it closely enveloped the nerve-roots, so that each root had to be carefully dissected out from the tumor tissue. Bleeding was only slight and was easily controlled. Suture of dura, muscles, and skin.

For several days after the operation the lower limbs were paralyzed. Three weeks after the operation he was sitting up in bed, and moving his lower limbs freely. All spasticity had disappeared.

The laminectomy wound healed by primary union. He did not, however, gain in weight, but became more and more cachectic. Soon he began to run irregular fever and to lose weight rapidly. Physical examination failed to show that there was malignant disease in another part of the body. He died eight weeks after the operation. Permission for an autopsy could not be obtained.

CASE II.—*Sarcoma Surrounding the Roots of the Cauda Equina: Laminectomy; Extrusion; Removal; Recovery.* Mrs. P., twenty-five years of age, service of Dr. Collins at the Neurological Institute. Pain in back, radiating down legs for two years, increasing loss of power in lower extremities with drop-foot; increasing difficulty in urination. Complete palsy of tibialis anticus group and of peronei on both sides; knee-jerks and ankle-jerks not to be obtained. Sensory disturbances in lower lumbar and sacral nerve-roots.

December 3, 1910: Laminectomy. Removal of spines and laminæ of eleventh and twelfth dorsal, first, second, third, fourth, fifth lumbar vertebræ and incision of dura, exposing very large tumor surrounding the roots of the cauda equina and extending upward around the conus. Tumor of soft consistency, of reddish-brown color, and not closely adherent to dura. Growth filled the spinal canal surrounding the nerve-roots of the cauda equina. As the tumor gradually bulged out of the canal it was determined to delay the removal. Suture of muscles and skin. Dry dressing.

December 10: Wound reopened. Tumor had been extruded to a great extent, and a great part of it lay outside of the spinal canal. A number of the nerves of the cauda were free of tumor. With little difficulty the greater part of the tumor was peeled

off from the roots of the cauda; some small pieces of tumor tissue had to be removed separately from between the roots. The tumor was easily freed from the conus and cord, leaving these structures covered by a thickened, very vascular pia mater. The inner surface of the dura was everywhere smooth and glistening. The tumor extended from the level of the eleventh dorsal vertebræ above to the end of the sacral canal below, it was fairly firm, and not very vascular. Pathological report: sarcoma.

After-course.—The wound healed by primary union. Gradual improvement in all symptoms. Return of full control of bladder. Steady improvement in power in lower extremities. Knee-jerks and ankle-jerks still absent. September 6, walking around with assistance; can sit and stand alone; knee-jerks and ankle-jerks still absent.

CASE III.—*Very Large Tumor Surrounding the Lower Part of the Cord and Cauda Equina; Laminectomy; Extrusion; Removal.* R. E., forty-one years old, service of Dr. Bailey at the Neurological Institute. One year history of pain in back and lower extremities, increasing loss of power in lower extremities; incontinence; impotence; sensory disturbances in legs. Steadily progressive symptoms. Lower limbs markedly paretic, especially the right; double drop-foot; no knee- or ankle-jerks; wasting of muscles in tibialis anticus and peroneal groups. Sensory disturbances over distribution of third and fourth lumbar and all of the sacral posterior nerve-roots.

June 14, 1911: Laminectomy (Dr. Elsberg), removal of spines and laminæ of twelfth dorsal, first, second, third, and fourth lumbar vertebræ, incision of dura. Enormous reddish-brown tumor filling up the spinal canal. Marked extrusion of tumor after incision of dura. Suture of muscles and skin, dry dressing.

July 22: Wound healed by primary union. Delay in operation due to weak condition of patient. Removal of large amount of tumor masses (Dr. Beer) after reopening wound. Most of growth removed in pieces with sharp spoon. Capsule excised as completely as possible.

After-course.—Wound healed by primary union. General condition improved. Slight improvement of sensory disturbances. No improvement in incontinence. Knee-jerks and ankle-jerks still absent. Pathological report of tumor: endothelioma.

CASE IV.—*Endothelial Sarcoma of Cauda Equina; Laminectomy (Eleventh and Twelfth Dorsal, First, Second, Third, and Fourth Lumbar); Extrusion; Removal; Recovery.* George S., thirty years of age, admitted October 1, 1911, service of Dr. Collins at the Neurological Institute. Two years' history of pain in small of back and lower extremities, sensory disturbances in lower limbs, increasing weakness. Weakness in lower limbs, absence of knee- and ankle-jerks; sensory disturbances over lower lumbar and sacral areas; tenderness over lumbar spine; rigidity of lumbar spine.

October 4: Laminectomy (Dr. Elsberg). Removal of spines and laminae of first, second, third, and fourth lumbar vertebrae in usual manner. Dura very thin and bulged out by large, reddish-brown tumor. Removal of spines and laminae of eleventh and twelfth dorsal vertebrae to reach upper end of growth. Tumor evidently growing between the roots of the cauda equina, pushing some of the roots backward but most of them forward. Tumor slightly freed from surrounding adhesion. Toilette of wound. Sutures of muscles, fascia, and skin.

October 10: Wound reopened. Tumor 10 cm. long found partly extruded from its bed in the spinal canal. A large number of nerve-roots now lying on the left side of the tumor. Larger part of growth removed in one piece. Numerous small fragments removed from between nerve-roots with sharp spoon. Bleeding moderate. Fragments of tumor tissue left behind without doubt. Toilette of wound; sutures of muscles and skin. Dry dressing.

October 21: Wound healed by primary union. Power in lower extremities improved. Some improvement in sensory disturbances. Unable to empty bladder so that catheterization is necessary. Knee-jerks and ankle-jerks still absent. General condition improved. To receive injections of Coley's fluid.

REMARKS.—The last three cases demonstrated the value of the extrusion method and the two-stage operation in these large tumors which surround the roots of the cauda equina. The difficulties met with in the removal of the tumor in Case I were very great, and by the necessary manipulations, much injury must have been done to the nerve-roots. In the other

three patients, the partial extrusion of the large tumors from the spinal canal made their connection with the nerve-roots much less intimate, hence their removal could be accomplished with less injury to the nerve-roots.

THE IMPROVEMENT IN SENSORY AND MOTOR DISTURBANCES
AFTER THE RELIEF OF PRESSURE UPON THE SPINAL CORD
BY THE REMOVAL OF SPINAL TUMORS, BONE DISEASE, ETC.
THE DECOMPRESSIVE EFFECTS OF LAMINECTOMY.

In the eight cases above referred to and in a number of other cases,⁵ I have made observations upon the disappearance of paralysis and of sensory disturbances, and the return of reflexes. It is obvious that the return of functions will vary with the variety and size of the tumor, the duration of the disease, the general condition of the patient, etc. Root pains usually disappear very rapidly, the most severe may disappear at once after the operation. After the removal of a tumor lying on the twelfth dorsal segment from a woman who had most violent pain referred to the right twelfth dorsal nerve-root for two years, the pain disappeared at once after the operation. In general, the sensory symptoms are the first to improve and the last to be entirely well; a disturbance of the deep muscle sense may persist for years after the operation.

In many cases, the improvement begins only after a number of days or weeks. In spite of the most delicate operative manipulations, all of the symptoms may at first become aggravated. In several patients in whom a laminectomy was performed in the upper dorsal region, the interesting observation was made, that all reflexes in the lower extremities could not be elicited for twelve to forty-eight hours after the operations. Similar observations have been reported by Bruns, Oppenheim, Flatau, and others.

In patients with advanced spinal symptoms of long dura-

⁵ Extramedullary tumor of cord, 2 cases; osteo-arthritis of spine, 2 cases; arachnoid cyst, 1 case, etc.

tion, however, and especially in those with marked cauda equina symptoms, the beginning of the improvement may be delayed for many weeks or even for months. Absence of knee-jerks and ankle-jerks may persist for years after most of the other sensory and motor symptoms have disappeared. It is obvious that where actual destruction of pyramidal fibres has taken place, exaggeration of knee-jerks, ankle-clonus, etc., may persist for many years or be permanent. After an operation for spinal tumor in which there has been no injury to the cord or nerve-roots, the improvement will occur in the following order: sensory (temperature, pain), then motor, finally sensory (touch), last of all deep muscle sense and sense of position.

THE DECOMPRESSIVE ASPECTS OF THE OPERATION OF LAMINECTOMY.

In a number of exploratory operations for spinal disease in which no gross lesion could be discovered, I have observed for days or weeks after the operation, a marked improvement in the sensory and motor symptoms. These have consisted of diminution in exaggerated tendon reflexes, such as exaggerated knee-jerks, ankle-clonus and Babinski, and decided improvement in sensory disturbances. These have been so marked in some of our patients, that it was impossible to explain them as a psychic effect of the operation. There must be some other factor involved, such as circulatory changes or the effect of the spinal decompression by the free removal of a number of spines and laminæ.

THE IMPORTANCE OF CAREFUL HÆMOSTASIS IN SPINAL OPERATIONS.

The amount of discomfort suffered by the patient upon whom a laminectomy with opening of the dura has been done is, in many instances, in direct proportion to the amount of bleeding that has occurred within the spinal meninges. It is of great importance, therefore, to control even the slightest

oozing of blood within the dura, and to make every effort to prevent blood from the outside entering the spinal canal. It is often possible to leave the pia-arachnoid intact, so that the fluid under the pia remains clear. In the removal of a spinal tumor, the small vessels should be carefully caught with fine mosquito forceps and ligated with the finest of silk. The posterior spinal artery has many anastomoses, and a ligature can be applied to it in any part of its course, with impunity. Great care in preventing bleeding within the dura may prevent the paræsthesias and root pains which are occasionally observed after these intradural operations. Delicacy of manipulation is, of course, all-important, both to prevent bleeding and injury of the delicate spinal structure. Spinal nerve-roots should never be handled with forceps; if necessary, they should be lifted up with small strabismus hooks.

THE IMPORTANCE OF CAREFUL SUTURE OF THE DURA, MUSCLES, AND SKIN.

Careful closure of the dura by a continuous suture of fine silk will be the surest preventive of cerebrospinal fluid leakage after a spinal operation, and the greatest safeguard against meningeal infection therefrom. The careful suture of the muscles and fascia will also contribute to this end. Good union of the muscles in their proper relations is important for the complete restitution of the functions of the vertebral column. It is well known that the main support of the vertebral column depends upon the intact condition of the bodies of the vertebræ, but the post-operative mobility of the spine will be much better if the muscles and fascia have been well approximated. I have not infrequently had to remove as many as six or seven spines and laminae, and have seen the patients with functionally perfect spinal columns after their recovery.



PROPHYLAXIS AND TREATMENT OF EPITHELIOMA OF THE LOWER LIP.

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AND

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THE extirpation of the neoplasm is, of course, the main point in the treatment of cancer, but this is not the question considered in this paper. This discourse treats of the origin and the recurrence of cancer of the mucous surface of the lower lip.

Almost all epitheliomas of the red of the lip begin on the surface and erode downward, and almost all if not all of these that so begin superficially are end results of seborrhœa.

This seborrhœa is connected with a line of sebaceous glands that anoint the exposed mucous surface. The line of these glands is often visible in lips that appear to be normal, as a slightly shaded or as a glittering band that stretches like a bow across the front of the lip between one corner of the mouth and the other, and in the median lines about half a centimetre above the cutaneous border. If the lip is seborrhœic, this line may be dry, brown, and faceted, it may be scurfy, it may be crusted, it may be keratotic and run along the apex of the lip as a white rough crest, or it may be heaped up in horny, tightly adherent masses. Although the seborrhœa tends to limit itself to this line, yet it may be much broader and interest the whole of the exposed mucous membrane. As in all these degenerative tendencies, the different symptoms show different degrees in different individuals. A patient may have marked seborrhœa oleosa of the face, with little tendency to form crusted localized patches and epithelioma. The lip on another may be markedly seborrhœic, while the skin is only slightly affected. A patient may have decided crusting of the

lip with no epithelioma, while, on the contrary, he may have an epithelioma with a seborrhœa that is only well seen on examination with a lens.

As regards the development of cancer, seborrhœa acts on the lip as it does on the cutaneous surface. The seborrhœa, at some point, becomes more decidedly crusted, and if this crust is scraped off, the tissue beneath will be found eroded. If this eroded portion is examined microscopically, it will be found cancerous.

Although the patient, whose history is about to be given, had epithelioma of the lip and coincident cutaneous cancer, and although we believe that the cancers developed in both situations because of the patient's seborrhœa, we do not maintain for a moment that the two kinds of cancer, that of the lip and that of the skin, are identical. The decidedly greater malignancy, the more rapid growth, the liability to form metastases, and the different histological structure put cancers of the lip in a different category from those of the skin. But all these differences are connected with differences in the nature of the infiltrating epithelial cells, and have nothing to do with the causes inciting these cells to pathologic activity. The same whip may incite both a race horse and an ox to unusual activity, but the animals themselves and the speed elicited are very different.

In reading the above, one might suppose that no attention is to be paid to irritation as a cause of epithelioma, which would be contrary to all clinical experience. In smoking, the irritation of the pipe, the drying effect, and the irritation of the smoke, of the nicotine, and of the products of combustion, all fret the sensitive lip of those having seborrhœa. The patient, the subject of the present paper, had been a heavy smoker, but it was noteworthy that his greatest and earliest cancerous degeneration took place, not on the lip, but on the skin of the face, and not until very recently had anything like cancer appeared on the lip. In regard to the irritations, it is also well known that atmospheric influences, such as heat, cold, strong sunlight, and rude weather act particularly

harshly on the skin of those having seborrhœa, and aid in the development of epithelioma of the face and hands. The well-known "sailor skin" of the fisherfolk of the North Sea and German Ocean is an example of this. In the same way we have seen seborrhœic crusts and a consequent epithelioma of the exposed mucous membrane of the lower lip correctly referred to exposure in driving an automobile across the hot sandy valleys of California. But in all probability the influence of these external agents has frequently been exaggerated. Pusey, for instance, in regard to smoking, remarks that he had run across proportionately as many cancers of the lip in non-smokers as in smokers, and this agrees with our experience.¹

The condition of a seborrhœic lip is best explained by referring to the accompanying photograph (Fig. 1). The black irregular patches on the lip were not really black, but were red crusts of dried blood. In the middle line and to the patient's right these scabs were irregularly scattered over the exposed mucous membrane. To the left of the median line is found a characteristic row of small black dots just above and parallel to the cutaneous margin along the sensitive seborrhœic line above mentioned. This crusting, which is best seen by examining the photograph with a low power lens, ran to the left corner of the mouth. Although the linear arrangement of the disease was not so marked to the right of the median line, yet the roughness and desquamation could be seen to also run out to the right corner of the mouth, so that the whole exposed red surface of the lower lip was diseased from corner to corner. When the crusts were scraped off two shallow erosions were exposed, both of them under the heaviest crusting to the right of the median line. On applying trichloracetic acid to these erosions, the posterior wall of one of them showed a fairly deep, easily bleeding crack, indicating that at this point epitheliomatous infiltration had extended well down into the subjacent connective tissue.

This condition of the lip was only part of a general seborrhœic process affecting the exposed surfaces of the face, neck,

¹The Principles and Practice of Dermatology, Wm. Allen Pusey, Second Edition, p. 907.

ears, and back of the hands. The patient was a miner, forty-seven years of age, whose habits were good with the exception of being a heavy smoker and a hearty cream and butter eater. We mention this because we have reason to suppose that the ingestion of a large quantity of milk fat inclines toward seborrhœa, and smoking is, of course, understood to be definitely related with cancer of the lip. The patient first came to us Sept. 17, 1909, with seborrhœic crusted patches scattered over his face, and a superficial ulceration near the inner corner of the right eye on the side of the nose. There was a large, prominent, heavily crusted, granulating mass on the left cheek, and there were many scars on the face where former lesions had been.

Because of the exuberant granulations of the lesions of the left side of the face, and the scarrings, which we afterward ascertained were the result of former operations, a Wassermann test was made, resulting negatively. He was, however, given iodide of potash and injections of salicylate of mercury, but these had no effect on the condition.

The lesions near the left corner of the eye were curetted and cauterized with a Paquelin cautery, and those of the left cheek and left side of the neck were curetted and cauterized with pure chromic acid crystals, after which the resulting crusts were removed, and the raw surfaces were exposed to X-rays.

Histologically all these lesions were found to be typical epitheliomata.

On examining the skin of the face, aside from the crusting and the ulceration, it could be seen to be profoundly seborrhœic. The mouths of the sebaceous glands were patulous, the skin was greasy in some places and red and desquamative in others, and the complexion, where it was not reddened by inflammation, was a straw yellow. This yellow color in many places shone through the skin as small granules, and was evidently due to diseased sebaceous glands. Some of the surface was covered by greasy crusts, and in the photograph (Fig. 2), these can be seen as black spots, representing, in some instances, where the process has gone on to epitheliomatous erosion. In fine the skin of this man's face showed an inveterate tendency to malignant epithelial degeneration, and was an excellent example of epitheliomatosis. The exposed mucous membrane of the lower lip participated in this same tendency.


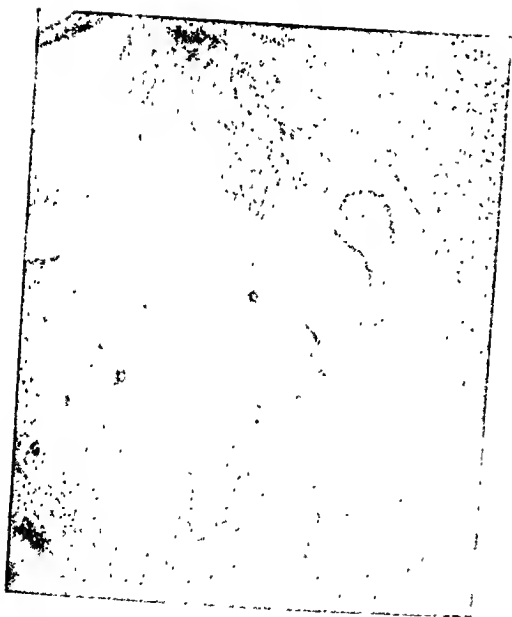


FIG. 1.



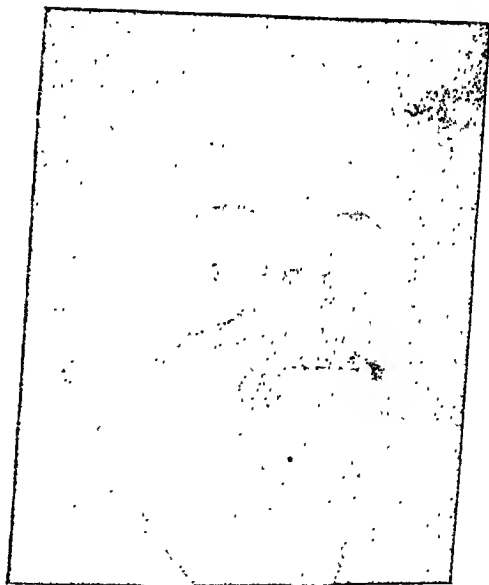
Seborrhœic crusts of the lower lip undergoing cancerous degeneration.

FIG. 2.



Large scar of the left cheek resulting from euretting and cauterization with chromic acid. The scar is smooth and free of seborrhœa. Anterior to the main scar there is an irregularly scarred surface where some of the sebaceous glands were not destroyed. On these intact patches of skin seborrhœa has developed and consequent small epitheliomata, shown in the photograph as black dots.

FIG. 3.



Photograph loaned by Dr. Wm. Pusey, showing an epithelioma together with dark patches on the mucous surface of the lower lip, that are probably seborrhœic. Scars and seborrhœic patches are seen on the face, and what is probably an epithelioma on the right cheek.



It is surprising that a condition having such grave consequences should receive so little attention from dermatologists. The reason it is slighted by surgeons is more evident, as their training is not such as to lead them to pay much attention to a scurfiness of the lower lip. They meet with graver situations that demand instant action, and this action being taken, their work is done. They daily "walk between the living and the dead," and a homily to a patient in peril of his life, laying out to him, in long-winded phrases, how he came to fall into trouble, would be highly inappropriate. When they are consulted, the symptoms of the cancer are so prominent and so grave as to hide or to overtop all others, and any other symptoms on the lips are looked upon as trifling secondary appearances. Furthermore, for some time after the operation is over and the wound is healed, the seborrhœic symptoms of the adjacent mucous membranes are much diminished, on the well-known principle that in the presence of an inflammation of great intensity an inflammation of lesser intensity vanishes. Psoriasis is a striking example of this principle, where the eruption will disappear entirely on the patient's getting pneumonia, to reappear shortly after recovery from the pneumonia. If a man wishes to get an idea of what an advanced stage a frankly ulcerating epithelioma represents, let him have some experience in curetting keratotic seborrhœic patches from the skin, such as those seen in the case above reported, and he will be surprised at the depth of the rotten erosions under some apparently superficial crusts. As above mentioned, there were two well-marked erosions hidden under the crusts of this man's lower lip. When a patient presents himself with a crusted lower lip, it should be carefully examined, not alone with the naked eye, but also with a low power lens. Every man should carry such a lens, and as Grindon says, his affection for such an instrument should not be Platonic, he should use it.

There are several reasons why dermatologists do not mention this condition. In the first place, because of the red color of the mucous membranes, inflammations are not as readily

recognizable on them as on the skin. Then again desquamation, that plays such a rôle in the symptomatology of the skin, has to be very severe before it becomes evident on the moist mucous membranes. Furthermore, many dermatologists feel that they are not interested in the lips any more than in the tongue, and they are especially not interested in cancer of the lips as being so evidently the surgeon's work. Therefore, as the condition is on the border both as regards treatment and situation, between two stools the patient falls to the ground.

The condition, however, has not escaped Fordyce, who for so long has been interested in the pathology of the lips. He significantly remarks, in speaking of labial epithelioma, "a number of primary changes in the surface epithelium may precede ulceration or tumor formation. Hyperkeratosis over a limited area, followed by fissure and later by ulceration, is often observed."² We can subscribe to all this except the assumption that only a limited area is affected. If these hyperkeratotic lower lips are examined with a low power lens, we are sure most of them will be found diseased from one corner of the mouth to the other. Fordyce, moreover, does not, in this article, connect up the epithelioma of the lip with seborrhœa, which to our mind is the chief point of interest. And we ourselves have been among those who have long ignored this condition of the lip and its relationship with seborrhœa of the skin, and now that our attention is drawn to it, are surprised at its frequency.

The matter of treatment is of the first importance. In the man, the subject of the photographs, whose history is given in the present paper, the seborrhœa was in an advanced state as indicated by the bloody crusting, and the whole lip was curetted and burnt with trichloracetic acid. Trichloracetic acid is an exceedingly powerful keratolytic, possibly the most powerful one we possess, but it must be handled with care. Immediately after applying it, its action should be controlled by the application of wet pledgets of cotton. After the crusts

² Handbook of the Med. Sciences, vol. xi, p. 683, by John A. Fordyce.

caused by the caustic are cast off, the lip should be treated with X-rays. Care in watching the effect of this remedial agent is also necessary, as a burn of the mucous membrane may be a serious matter. The use of the X-rays, so efficacious in the seborrhœids generally, is here at its best, and is by far the best agent we possess. The ray's action is not deep, however, and this accounts for its bad reputation in epithelioma of this region where cancer is so apt to strike in deeply and quickly. For the seborrhœic eczema itself, however, and for the shallow erosions, there is nothing better. This accounts for the occasional wonderful effect in cancer in such cases as mentioned by Hartzell at the last meeting of the American Dermatological Association. In all probability the infiltration in such instances is far more superficial than clinically it appears to be. We have before called attention to the deceptiveness of the depth of the infiltration of cancer in this region. When it appears to be shallow it is often deep, and when it appears to be deep, its apparent depth is often caused by a coincident inflammation. In this matter there is no absolute trust to be put in anything short of curetting.

The statistics of reliable surgeons as regards recurrence in cancer are interesting. Serafini, in reporting results in 100 cases, says that recurrence took place in the lip in 24, and in the submaxillary region in 17.³ J. Clark Stewart says that after the radical operation, although he cannot give exact statistics, he believes that the recurrences will be less than 10 per cent., and that most of these in reasonably early cases will be local.⁴

If we are correct in our view of the early pathology of many of the epitheliomas of the lip, local recurrence is a perfectly natural event, as in these cases the whole lip is affected with a disease that naturally eventuates in epithelioma. For those, therefore, who would rather remove a diseased member

³ Considerazioni statistiche sull'epitelioma del labbro, by G. Serafini, *Gazzetta degli Ospedali*, p. 644, Abst. in *Jour. A. M. A.*, Sept. 8, 1906.

⁴ The Radical Treatment of Epithelioma of the Lip, *Jour. A. M. A.*, Jan. 15, 1910.

than patch it, the radical removal of the entire mucous membrane of the lip, when seborrhœa of the lip exists, would be the only logical course. But as seborrhœa of the lip is usually associated with advanced seborrhœa of the face, and any reslitutory flaps got from the patient's own face would also be seborrhœic, then the academically logical procedure would be to flay the face. In the subject of the present paper it would be absolutely necessary to flay the whole face, as the man was affected with a form of seborrhœa showing a peculiar and inveterate tendency to epithelioma; the form that, as before mentioned, is known among dermatologists as epitheliomatosis.

Reference has been made to the amenability of seborrhœa of the lip to treatment. This statement must not be taken as meaning that either the constitutional or cutaneous seborrhœic condition can be cured. This can be no more cured than gout, but many of the seborrhœic manifestations may be controlled for a whole lifetime, and for this many patients are rightfully and devoutly thankful.

ACUTE, SPONTANEOUS PERFORATION OF THE BILIARY SYSTEM INTO THE FREE PERITONEAL CAVITY.*

A REPORT OF SIX CASES FROM THE PRESBYTERIAN HOSPITAL OF NEW YORK AND 108 CASES FROM THE LITERATURE.

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HAVING personally had two cases of perforation of the gall-bladder into the free peritoneal cavity, my attention was called to the subject and I have gone over all the histories of operations on the biliary system in the Presbyterian Hospital for the past fifteen years. There were 365 such operations, with six cases in which the bile had extravasated through a perforation in the biliary system into the more or less free peritoneal cavity. Such perforations are rare, and not many of these cases occur in the experience of any one man. One is, however, likely to meet with such a case at any time, and one should not be taken off one's guard when confronted with such a condition.

It has seemed to me that something might be learned from going over the recorded cases in the literature. I have been able to collect 108 cases of perforation into the free peritoneal cavity and a table of them appears at the end of this article. The six cases which occurred in the Presbyterian Hospital are as follows. But two of these six died.

CASE I.—Chinaman, thirty-eight years of age. History 13622, Sept. 25, 1911. Ambulance. History difficult to get and through an interpreter. Slight attack similar to present illness several years ago. Attacks of digestive disturbances. Onset sudden three days ago, with epigastric pain, nausea, and vomiting. Next day pain localized in right lower quadrant, radiating up

* Read before the New York Surgical Society, November 22, 1911.

and down. No vomiting since yesterday but pain is getting steadily worse. Bowels constipated for three days.

Examination.—Well nourished but prostrated. Leucocytes, 10,000; polymorphonuclears, 85 per cent.; pulse, 114; temperature, 101°. Abdomen full, distended generally though not extreme. Does not move with respiration in lower half and only slightly above. Whole abdomen feels resistant and walls are tense, preventing palpation freely. General muscular rigidity but most marked in right lower quadrant. General tenderness but acute only in right lower quadrant. A little above McBurney's point, where slight pressure causes pain, there is sense of a mass about the size of a large orange, exquisitely tender. Tympany everywhere except a little dulness in each flank.

Clinical Diagnosis.—High gangrenous appendicitis with spreading peritonitis.

Operation at once, Dr. McWilliams, at midnight, Sept. 25, 1911. Gas and ether. High McBurney incision made. On opening peritoneum turbid, greenish-yellow, somewhat purulent, odorless fluid escaped, being free in cavity. Appendix not located. Cæcum involved in mass of recent adhesions. On passing finger upward separated weak adhesion, following which there was a gush of great quantity of bile mixed with flocculi. Right rectus incision over gall-bladder emitting large amount of bile. Omentum adherent to liver. Separated. Great difficulty in finding gall-bladder. It was found deep in posteriorly, very small and contracted, with a perforation admitting tip of finger in cystic duct directly over a large curved calculus. Gall-bladder incised and stone removed. On account of patient's condition, nothing further done. Tube sewn into bladder and two tubes into Morrison's pouch. Closure about tubes.

Patient in poor shape after operation. Infusion 1200 c.c. salt solution with adrenalin 20 minims. Died next morning, eight hours after the operation. No autopsy.

Result of Cultures.—Smears, many pus-cells but no bacteria. Cultures. Predominating cocci in groups and a few gram negative bacilli.

We have in this case both the mechanical and infectious factors present. How much the infection had to do with the perforation it is difficult to say, but the stone had certainly

ulcerated the duct which was tightly drawn over the large stone. Had this man been operated upon on the first day of his illness, there might have been a chance for his life, but the form of infection, streptococci, is against any form of peritonitis recovering. It was also unfortunate that a diagnosis of appendicitis was made, for there was evidence of beginning adhesions about the cæcum, and had the gall-bladder been opened at the beginning the peritoneal cavity would not have been so soiled.

CASE II.—Man, aged sixty-seven years. Admitted August 20, 1911. Ambulance at 3 P.M. Operator Dr. McWilliams. Complaint, pains all over abdomen, mostly on right side. About two months ago patient had very severe attack of pain on right side just below ribs. Had to stop work for a week. Had constant attacks of nausea and vomiting. Appetite poor. Bowels constantly constipated. Pains gradually wore away. Well until yesterday when suddenly, while bending over a lathe, sudden abdominal pain, so severe that patient could not stand up and knees were drawn up while in bed. Pain was all over abdomen, but most of the tenderness below ribs and lower down on right side. Nausea was extreme and he vomited a great deal of greenish-brown fluid. Took cathartic and bowels moved well.

Examination.—Markedly prostrated, tongue heavily coated. Pulse 88, fair force, slightly irregular. Temperature 99.4°, leucocytes 24,000, polymorphonuclears 92 per cent. Abdomen held rigid, tympanitic over all, with partial obliteration of normal liver dulness. Entire right side of abdomen very rigid, board-like as one finds in stomach perforation, extending to a less degree to left rectus. Excessive tenderness just above right internal ring. Left inguinal hernia, but easily reducible. Right external ring dilated but no impulse. No peristalsis could be heard over abdomen. Some tenderness on rectal examination.

Clinical Diagnosis.—Intestinal obstruction, origin unknown.

Operation at once. Kammerer incision over appendix. Bile poured out of wound in great amount. Removed by passing Blake's irrigating tube into pelvis. Vertical right upper rectus incision. Large amount of bile escaped with particles of fibrin mixed with it, and pus. Large perforation of fundus. No stones in bladder, but finger felt a large rough one impacted in cystic

duct. Extracted with Blake's gall-stone forceps. Common duct free, but foramen of Winslow obliterated. Rubber tube sewn into opening in gall-bladder, and the edges of the bladder inverted about the tube by two purse-string sutures of plain catgut. Two rubber tubes, one containing gauze strip, into Morrison's pouch. One tube in appendix wound. Both wounds closed about tubes.

Patient made an uninterrupted recovery. Discharged Sept. 22 to his own physician, with a granulating wound discharging a small quantity of bile. Patient seen, Dec. 1, 1911. Entirely healed and perfectly well. No gastric nor intestinal disturbances.

CASE III.—Man, twenty-six years of age. Admitted Jan. 20, 1907. Operator, Dr. McCosh. Private patient. Three years ago attack of jaundice, grew deeper for a few days, and one night attack of pain for an hour in right hypochondrium. Five months ago similar attack but much severer, lasting for five days and with deep jaundice. Four months ago another attack and also three weeks ago, which last attack has not as yet subsided. Skin jaundiced, stools clay-colored. Pain now severe in right hypochondrium.

Examination.—Prostrated, deeply jaundiced. Abdomen held rigid on entire right side, most markedly so in right upper quadrant. Tenderness over whole of right side of abdomen and dulness over gall-bladder region. Temperature 101° , pulse 104, leucocytes 11,660, polymorphonuclears 80 per cent.

Operation at once. Incision over gall-bladder, which was found gangrenous and perforated at fundus, and surrounded by large amount of bile and pus. No stones found anywhere nor in common duct. Cholecystectomy. Tube into stump of gall-bladder. Uninterrupted recovery.

CASE IV.—Male, forty-nine years old. On Medical Division for nine days. While there temperature 99.5° to 102.4° . Leucocytes on admission 36,000, on day of operation 40,000. When brought in gave a history that three weeks ago, severe frontal headaches and diarrhœa. Two weeks ago began to have pain in right upper quadrant. Next day went to bed with a temperature of 102° . Chill the day before admission. No vomiting, bowels loose. Two days before admission became acutely delirious and was then brought into the hospital.

Examination.—Large mass made out occupying right side of abdomen, tender, and muscular rigidity. Dulness over it, evidently an abscess.

Operation, Dr. Brown, Sept. 20, 1901. Incision through right upper rectus, giving exit to large amount of bile and pus with a stinking odor. Numerous adhesions. Gall-bladder perforated at fundus, and from it was removed a single, non-facetted stone, the size of a pigeon's egg. Tube drainage of bladder and a second tube into the space below the gall-bladder.

Uninterrupted recovery. Discharged Oct. 19, 1901, with a sinus still discharging pus.

CASE V.—Male, forty-nine years of age. Private patient of Dr. Blake. Three months ago vague shooting pains, worse when stomach was empty and relieved by food. No vomiting. Alkali treatment, and got well. Two days before admission, marked abdominal discomfort, vague in character, localized in right upper quadrant of abdomen and small of back. Sense of fatigue and constant desire for food. These symptoms continued until to-day, when he was seized with sharp pain localized in right upper quadrant.

Examination.—Acute tenderness in right side of abdomen, more so over gall-bladder, with great muscular rigidity. No mass could be made out.

Operation at once. Bile free in abdomen and a collection of it in right gutter. Gall-bladder gangrenous in spots and contracted. Interior full of small stones. Gall-bladder removed. General abdominal irrigation with Blake's irrigating tube. Tube into stump and two tubes in bed of gall-bladder.

Uninterrupted recovery. Smears and cultures taken at the time of the operation were sterile.

CASE VI.—Male, thirty-one years of age. Operator, Dr. Hawkes, March 17, 1906. An Italian. Heavy drinker up to three years ago. Never an attack similar to present one, which began four days before admission with sudden onset of pain under right lower ribs, with chill, fever, nausea, vomiting, prostration, and constipation. Pain did not radiate and was increased by movements in bed. Vomitus contained food remnants, no bile nor blood. Pain continuous ache, gnawing, not colicky, and none in shoulder. Did not notice that he was jaundiced until attention was called to it in hospital.

Examination.—Temperature 101°, pulse 120, leucocytes 15,000, polymorphonuclears 84 per cent. Exquisite tenderness and rigidity of right rectus, especially its upper part. Respiratory

movements much limited on right side. Somewhat distended. On account of rigidity and tenderness, no mass could be made out, but marked flatness below right costal arch. Deeply jaundiced.

Operation: Liver edge found adherent to transverse colon and to anterior abdominal wall by recent adhesions. Gall-bladder not made out. On breaking through adhesions toward duodenum, profuse discharge of thick, creamy, foul-smelling pus mixed with bile. Rubber drainage tube, surrounded by gauze.

After-course.—Jaundice never lessened. Profuse discharge of bile from wound. Had occasional chill and sweat. Lost ground gradually. Temperature remittent, as high as 103° some days. Leucocytes on April 3, 39,000, on the 5th, 62,300, with polymorphonuclears 91.5 per cent. Went into coma and died on the twenty-first day after operation. No autopsy.

Pathology.—The ordinary peritonitis arising from the gall-bladder is usually due to simple diffusion of infection through its walls to the peritoneum. It may result in a collection of pus of greater or less extent about the gall-bladder, but it is almost always well walled in by adhesions and represents a beautiful example of curable localized peritonitis. A very rare condition indeed is a generalized peritonitis due to lack of adhesions and without perforation. Korte has, however, reported three such cases. There are four cases recorded in the literature in which bile was found free in the peritoneal cavity, but in which there was no perforation of the biliary system. One is by Richardson, who says: "In one instance I found the right upper quadrant flooded with bile which had escaped from a gall-bladder that was apparently normal. Drainage was successful." Similar cases are recorded by Clairmont, Schievelbein, and Finsterer.

Much more serious, however, in its consequences and with a mortality rate not much under that of perforations of the alimentary tract must be ranked perforations of the biliary system into the free peritoneal cavity. Normal bile is sterile and is fairly well tolerated in large amounts and for a long time by the peritoneum, in which is set up a chronic irritation which results in the walling-in of the bile. This is well illus-

trated in traumatic rupture of the gall passages. Witness the interesting case of Garre, in which, two months after the injury, a large quantity of bile was evacuated and the patient was then cured by hepatocholeangio-enterostomy; or the case of Hildebrandt, in which operation on the twenty-third day after the injury disclosed a tear in the hepatic duct, recovery following.

In rabbits Noetzel has demonstrated that after an aseptic laparotomy the gall-bladder can be incised and left to drain into the free abdomen, after which the abdominal wound is tightly closed. The animals regularly survived this procedure. In a second set of experiments, he demonstrated that, after opening the peritoneum, the animals recovered after infections were introduced into the cavity, of certain amounts of *Staphylococcus aureus*, in other animals of *Bacillus coli communis*, in others of *typhoid bacilli*, and in others of *streptococci*. He also demonstrated that if even smaller amounts of these organisms were injected into the abdomens of animals and, at the same time, their gall-bladders were incised and left open in the abdomens and the abdominal wounds were then closed, the animals regularly died of septic peritonitis. These experiments show the deleterious effect of bile in contact with peritoneum in exalting the virulence of the organisms. In addition bile diminishes phagocytosis, and by this double mechanism it decreases the means of natural defense of the peritoneum toward infection. Conradi has shown that bile for typhoid bacilli is a good culture medium. He has also shown that the addition of bile to a normal blood-serum promptly does away with the bactericidal properties of such serum, for, if we take 0.3 c.c. normal guinea-pig serum in a dilution of 1 to 80, we will find that this amount will kill 20,000 typhoid bacilli in two hours. If we now add 1.1 c.c. of bile to the same amount of normal guinea-pig serum, a bactericidal effect of the serum cannot be demonstrated, but on the contrary the added typhoid bacilli will grow without any hindrance.

Neufeld and Handel have shown through experiments

that this paralytic effect upon the bactericidal quality of the blood evidently rests upon the energetic binding of the complement with the salts of the bile. According to them, sodium taurocholate unites not only with the bactericidal complement, but also with the hæmolytic. These experiments explain why such a rapid destruction of the animals takes place when bile is mixed with weak infections in the abdomens of the animals. There results a great decrease in the bactericidal properties of the serum poured out into the abdomen in response to the irritation, and the animals die of sepsis, or rather of septic peritonitis.

Etiology of Perforation.—We may group these as follows:

1. Rupture from overstretching, with or without stones.
2. Perforation from pressure of a stone upon the wall, causing ulceration.
3. Perforation from gangrene, due to (a) thrombosis of vessels, with or without stones; (b) cutting off of circulation from pressure of a stone; (c) diphtheritic, ulcerative infection of wall, with or without stone.

It is not necessary to do more than state these facts, and discussion of them would be superfluous. The important point from a prognostic and therapeutical aspect of the subject is the amount and virulence of the infection present in the biliary system at the time of the perforation. We may group the cases then into two classes:

1. Those patients with latent stones in their biliary systems who have had no attacks of infection for some time. The contained bile is evidently not perfectly sterile, and if one were to take cultures from it, one would find numerous pathogenic bacteria, but they are actually well tolerated. Such a bladder may become distended, due to obstruction from impaction of a stone in the cystic duct or neck of the bladder, or, if no stones be present, from stricture of the duct with a coincident swelling of the mucous membrane, or from a kink in the cystic duct. Its walls may become paper-thin from overstretching, or very brittle from old chronic inflammation, or weakened from ulceration due to the pressure of a stone. In

such conditions it may be brought to sudden bursting by reason of the compression exercised upon it by the abdominal muscles in the act of coughing, or vomiting, or of bending over. There results a pouring out into the peritoneal cavity of a quantity of bile of a little septic character. It is mechanical in origin and infection plays a small part in the process. There is no great reaction of the peritoneum as a result of its contact with the bile, save in the formation of more or less abundant fibrinous adhesions. An intervention leads to a good prognosis, provided it be not too long delayed, for it prevents the development of secondary infectious complications which are likely to follow if one abandons the patient to his own means of defense; for as we have already seen, the previously existing latent infection may become exalted in its virulence, due to the bactericidal effect of the serum poured out into the peritoneum being diminished by reason of its mixture with bile, while at the same time there is no exit to the infectious fluid which itself is a good culture medium. In addition, one must not lose sight of the fact that infectious agents may emigrate directly from the intestinal canal into the peritoneal cavity through the perforation. Blake reports a case in which there was a primary abscess about the gall-bladder which later burst into the general peritoneal cavity with a fatal issue.

2. The second and grave type is that in which the perforation is directly due to infection and its results. There is present a more or less acute cholecystitis, with obstruction, and the gall-bladder may rupture from increasing tension or through a spot of gangrene of its wall, which may occur because of the cutting off of the circulation through thrombosis of its vessels or by reason of the pressure of a stone. Or an abscess situated in the wall may rupture, thus weakening the wall and leading to a perforation through distention. The process is much less mechanical than infectious, *i.e.*, the calculus plays a secondary rôle, and may be entirely absent. Obstruction may occur through the swelling of the mucous membrane dependent upon the intense inflammation of the

mucous membrane of the cystic or common duct. The perforation may be very sudden and acute, so that the peritoneal cavity is inundated by a very septic fluid with a resulting more or less general peritonitis. The prognosis in such a case may be very grave and may tax the surgeon's judgment to the utmost. A contracted gall-bladder will not contain very much fluid and, if, at the time of rupture, there be no relief in the obstruction, it will take several days for much bile to collect in the abdomen. If, on the other hand, the gall-bladder be thin-walled and much distended, the amount of fluid escaping through the perforation will be very large.

Between these two types there are all grades of commingling. In some cases there is difficulty in saying which element predominates, the mechanical or the infectious. It would seem in some patients with chronic empyema of the gall-bladder as though the calculus and the microbes mutually agree to end in perforation. In the vast majority of cases, perforation of the walls does not progress so rapidly as to take the peritoneum unawares, so that adhesions have time to form. In the rare case, however, with rapid perforation, no adhesions are present, and the rapidity and extent of the consequent peritonitis will depend on the amount of the extravasated bile or pus, and the virulence of its contained organisms. A pinhole perforation of a contracted bladder with a stone blocking the escape of bile will cause the development of a slow, more or less localized peritonitis, while a large sudden perforation in a much distended and infected bladder will cause an overwhelming general peritonitis similar to that which we find in perforation of the stomach or duodenum.

The gall-bladder mucosa presents numerous alveoli formed by fibromuscular bands. They are of various sizes and shapes, and in them we often find large or small calculi which are difficult to enucleate and are, as it were, let into the wall. The alveoli also contain septic fluid and are therefore an excellent culture medium for micro-organisms. The result is an ulcerative process which may lead to perforation and peritonitis. Dieulafoy says that the *Bacillus coli communis* seems to be an essential agent in the ulcerative process. Certain it is that

nothing can be elicited from the reported cases as to the bacteriology of these perforations, for in but very few cases have cultures been taken at the time of operation.

Of 90 cases in which the situation of the perforations is mentioned, 82 of them, or 91 per cent., occurred in the gall-bladder, 3, or 3.3 per cent., occurred in the cystic duct, 4, or 4.4 per cent., in the common duct, while but 1, or 1.1 per cent., occurred in the hepatic duct.

In 80 out of 108 cases, or 74 per cent., stones were found at the time of the operations for perforation. From this fact we may infer that calculi, single or multiple, are a great factor in causing perforation. In 14 cases, or 13 per cent., it was found that no stones were present after adequate search. In the 14 remaining cases, or 13 per cent., stones may or may not have been present, as no mention is made of them. Many of these cases were simply drained without search being made for stones.

In but 9 cases is it distinctly stated that gangrene was present. It usually was simply a small area of gangrene, and through this the perforation took place.

Frequency of Occurrence.—That general peritonitis due to a perforation into the free cavity is a rare occurrence the following table of frequency will indicate. No one operator has had many cases, and our ideas of the lesion can only be gained by putting together the single observations of many. Because of the heavy mortality following perforation of the biliary system into the free peritoneal cavity, probably most of the isolated cases have not been reported, so that to gain information as to the relative frequency one must go through the reported series of operations on the biliary system.

	No. of Operations	Cases of Perforation
Adám	112	3
Robson	539	3
Ochsner	48	1
MacLaren	80	4
Kehr	1526	1
Korte	254	7
Jenckel	210	3

	No. of Operations	Cases of Perforation
Ferguson	46	1
Pres Hosp. (McWilliams)	365	6
Totals	3180	29*

Thus we see that the occurrence of perforation into the peritoneal cavity is a very rare accident indeed. There were but 29 cases in 3180 biliary operations. One almost never finds it mentioned in text-books or articles on the differential diagnosis between acute lesions in the upper abdomen. While the lesion is a rare one, it is not so infrequent as one would be led to suppose from the small number of cases published. Are not many of these cases unrecognized? If a calculus completely obstructs the cystic duct, there will be nothing but pus in the gall-bladder with the formation of a purulent peritonitis after perforation, without free bile in the cavity. If there be nothing in the history to call the surgeon's attention to the gall-bladder, there may be nothing found on opening the abdomen in the usual positions to cause one to suspect that the gall-bladder is at fault, and a right diagnosis may not be made until the autopsy table be reached.

Age and Sex of the Patients.—There were 99 patients whose ages are given, and the average age was 50.2 years. The youngest patient was No. 49, whose age was 21 years, while the oldest was No. 44, who was 80 years of age. The disease is one of advanced life as the following statistics show: Between 20 and 30 years: recovered 7, died 2; between 30 and 40 years: recovered 7, died 5; between 40 and 50 years: recovered 14, died 9; between 50 and 60 years: recovered 14, died 21; between 60 and 70 years: recovered 7, died 7; between 70 and 80 years: recovered 4, died 2. Before 50 years there were 44 cases, while there were 55 cases beyond 50 years. Before 50 years there were 63 per cent. of recoveries, while there were but 46 per cent. after 50. How great an influence diseased blood-vessels have upon necrosis and gangrene of the gall-bladder it would be difficult to say.

* Or 0.9 per cent.

The statistics as to sex are as follows: Females: recovered 35, or 56 per cent.; died 27, or 44 per cent.; total 62, or 60 per cent. Males: recovered 19, or 46 per cent.; died 22, or 54 per cent.; total 41, or 40 per cent. From this we find that 60 per cent. of the cases occurred in women and that they stand the disease better than men, the mortality in women being 44 per cent. as against 54 per cent. in men.

Symptoms and Diagnosis.—Peritonitis due to perforation is a most treacherous complication. It may come on during an attack of biliary colic, and as the symptoms in each case are similar (violent pain and vomiting), it may cause serious mistakes. If an attack of colic leaves a very tender gall-bladder region, the patient should be operated upon at once, but if, for any reason, this be not done, then the patient should be very carefully watched. The degree of spread of infection from the gall-bladder is the important point, as judged by the change in the extent of the abdominal rigidity, tenderness, fever, pulse, leucocytes, and polymorphonuclears. All the cases of perforation were ushered in by pain. If a cholecystitis had been present, then the character of the pain changes. From being a more or less dull, continuous localized ache it becomes generalized over a greater extent of the abdomen, down the right side, and to the navel. There may be in some cases at the time of perforation a sense of temporary relief as the tension of the distended gall-bladder is relieved by the fluid effused from its cavity. This is followed by the signs of peritonitis, more extensive rigidity and tenderness, nausea, vomiting, distention, rapid pulse, temperature, and prostration. In some cases perforation is sudden and without warning, and the symptoms are then like those in perforation of a stomach ulcer. More than one patient with perforated biliary system has been operated upon with the diagnosis of perforated gastric ulcer. In this type we find sudden intense pain, which cannot often be localized but is said to spread over the whole abdomen. The patients become rapidly prostrated, collapsed, vomiting soon follows, and the rigid and tender abdomen becomes distended, flatus

ceases to pass, and the pulse becomes rapid and irregular. After a few hours the patient may rally, having the "interval of repose" seen in all forms of perforation within the abdomen.

The tendency of the material which escapes from the gall-bladder is to gravitate downward along the outer side of the ascending colon into the appendical region, which becomes tender and rigid, and at once gives rise to the opinion that one has to deal with a perforated appendix. This is a very frequent mistake in these cases. A careful history and the location of the early symptoms, such as pain and muscular rigidity in the region of the gall-bladder, will enable us often to make a differentiation. A right diagnosis will spare the patient an unnecessary incision and the loss of valuable time with the added danger of opening up protective adhesions. In both my own cases, a wrong diagnosis was made, in one case being due to the inability to get a proper history. A Chinaman (Case I) who spoke no English was operated upon under the diagnosis of perforated appendix, and an appendix incision made. It was not until a large collection of bile was opened into in searching for the appendix that the diagnosis was made of perforated gall-bladder. Thus the gravely infected bile was spread widely, and likely contributed to the fatal outcome, in addition to the added shock of the prolonged operation. The outcome of my second case was more favorable because the infection was not so virulent, due to the earlier operation. The diagnosis was probable intestinal obstruction of unknown origin. On making a Kammerer incision over the appendix, bile at once flowed out and the diagnosis was at once clear. Other diagnoses have been volvulus (Case 81), intestinal obstruction (Cases 18, 24, 91, 97), intussusception (Case 23), intestinal perforation (Case 98), perforated gastric ulcer (Case 47), and appendicitis (Cases 108, 92). One remarkable case is recorded by Kummel, in which a tumor supposed to be ovarian became acutely inflamed, peritonitis followed, with death in two days. The tumor on autopsy was found to be a distended gall-bladder.

The puzzling cases are those in which there is no sudden

large amount of effused fluid, but in which there is a steady small leakage. The pain in these cases is not very great in the beginning if the fluid be not very septic. The diagnosis of intestinal obstruction is apt to be made in these cases, due to the pressure of the collection of bile on the intestines and the paralyzing effect of its contained infection.

In 11 cases it is distinctly stated that jaundice was present at the time of the operation. Of these 6 recovered and 5 died. Its presence indicates an advanced case because, if not present at the time of the perforation, it comes on later from absorption of biliary pigment by the peritoneum.

What a large element infection plays in these cases is shown in the relative mortality of operations for traumatic rupture. Thus Ricketts reports 28 cases operated upon for traumatic rupture with 22 recoveries, or 78 per cent.

PROGNOSIS AND RESULTS OF OPERATION.

Duration from Perforation to Operation	Recovered	Died	Per cent. of Recoveries	Per cent. of Deaths
Within 12 hours...	6	1	85.7	14.3
1 day	10	5	66.6	33.3
2 days	7	7	50.0	50.0
3 days	8	8	50.0	50.0
4 days	2	8	20.0	80.0
5 days	3	4	42.8	57.2
6 days	2	2	50.0	50.0
7 days	1	1	50.0	50.0
10 days	2	1	66.6	33.3
11 days	0	1		
14 days	2	0		
Totals	43	38	53.0	47.0

The above table very graphically represents how important it is for these patients with perforation to be operated upon as soon as possible after the perforation. Thus in 7 cases operated upon within 12 hours of the perforation 6 recovered, or 86 per cent.; of 15 cases reported operated upon when the perforation had existed for one day, 10 recovered, or 66 per cent.; of 14 cases operated upon after two days, 7 recovered, or

be condemned, as it violates all our modern ideas of the treatment of biliary diseases.

Simple incision of the abdomen with drainage of the biliary region gave 47 per cent. of recoveries. Cholecystectomy accomplished very little more, 48 per cent. recovering. The best results were obtained with cholecystostomy with which 61 per cent. recovered. Many of the cases with simple incision were in desperate condition, and the gravity of the general state seemed to contraindicate further measures. It is a question open to discussion how much better results would have been obtained had a better means of drainage been provided, in some of the cases. Thus, the case of Korte (No. 31), which died on the eighteenth day, that of Hawkes (No. 95), which died on the twenty-first day after operation, and of others, brings up the question of whether an intervention more direct to the seat of infection with the drainage of the infected bile to the surface would not give better results. Each operator will have to decide this question for himself in each individual case.

How does it stand with cholecystostomy *versus* cholecystectomy? On first sight one is struck with the success of the former as compared with the latter, 61 per cent. of recoveries with cholecystostomy as against 48 per cent. with cholecystectomy. Cholecystostomy for the average operator is the less dangerous procedure, and should therefore be preferred in these perforative cases. But are there exceptions and, if so, what are they? Cholecystostomy has given brilliant results in some apparently hopeless cases, such as those of Korte, Kummel, Lecene, Mosetig-Moorhof, Thiel, Jaboulay, Whitacre, and others. In other cases the outcome has been such as to suppose that cholecystectomy would have been better. Witness the case of Hirschel (No. 16) who did a cholecystostomy in a patient with acute cholecystitis with gangrene of the neck of the bladder. At first he recovered, but died on the twelfth day of pulmonary gangrene. The same occurrence took place in a patient of Narath (No. 80) on the tenth day. Also the patient of Hartig (No. 12) who

had scarcely left the hospital after a cholecystostomy before he had a second perforation of his gall-bladder with a second operation, as a result of which he succumbed. Whitacre's case (No. 86) had two perforations at different times with two different operations with a successful outcome. These secondary ill-results would likely have been avoided by a primary cholecystectomy. The cases with pulmonary gangrene probably had their origin in a persistence of the focus of infection in the bladder gangrene. As a rule, then, we are justified in saying that cholecystostomy should be the operation of choice in cases in which there is little sepsis. In cases, however, where there is a severe infectious cholecystitis with an ulcerative or gangrenous process, *i.e.*, the grave cases, it were better to remove the focus by a cholecystectomy where this is possible. By this means some of the infecting process will be removed. A drain should always, however, be placed in the stump of the cystic duct, and the peritoneum also be drained. Adhesions should not, however, be broken up to accomplish this except to a slight degree. Should bile be free in the abdomen, it would be well to flush the whole cavity quickly with salt solution and to place a drain possibly in the suprapubic area. Nothing by rectum according to Murphy continuously, colon irrigation, and the Fowler position should constitute the after-treatment. Gall-stones should be removed at the time of the operation, and in draining, it should be borne in mind that the right kidney pouch forms a distinct peritoneal pocket and that a drainage tube applied through a stab opening in the right loin affords a free exit for extravasated fluids coming from the neighborhood of the gall-bladder.

There is great difference of opinion as to the wisdom of performing a cholecystectomy in these perforative cases. Summers (*ANNALS OF SURGERY*, July, 1911), says: "All infections of the gall-bladder, empyema, gangrene, should be treated by simple incision and drainage after a protective gauze packing off of the peritoneal cavity. I have known

disaster follow cholecystectomy in such cases—the crushing of the cystic duct and its artery, more especially of the poison laden lymphatics; the trauma to the peritoneum passing from the gall-bladder neck to the gastrohepatic omentum can and does in some instances lead to a thrombophlebitis and fatal infections. By free incision into the gall-bladder, gangrene will probably not extend and tension will be relieved.” Robson (“Gall-Stones,” 1909, p. 161) regarding perforative cases remarks: “Should marked cholecystitis be found, the question of cholecystectomy may be worth considering; but when the patient is in a critical condition, it is a mistake to attempt too much, and, as a rule, cleansing and free drainage will be all that are necessary or advisable at the time, the removal of the cause being left until the patient is better able to bear a more prolonged operation.” Moynihan writes regarding the treatment of perforative cases (“Gall-stones and their Surgical Treatment,” 1905, p. 279): “In all probability cholecystectomy followed by free drainage will prove to be the safest method of treatment.” Cotte and Arnaud say (*Revue de Chirurgie*, March, 1911, p. 358): “In all biliary perforations without a concomitant grave infectious state, one can in general content himself with making a simple drainage of the biliary system. In the grave forms, on the contrary, which result from an active process of ulceration or of gangrene, every time that the situation permits it, one should prefer the ablation of the gall-bladder.” Mayo, in Keen’s “Surgery,” vol. iii, says regarding perforations of the gall-bladder: “The treatment should be immediate abdominal section for the removal of the gall-bladder and free drainage.”

CONCLUSIONS.

1. In 3180 operations on the biliary system, acute spontaneous perforation into the free peritoneal cavity occurred 29 times, or 0.9 per cent. It is thus a very rare accident.

2. In 90 cases of perforation, 82 of them, or 91 per cent., occurred in the gall-bladder, 3, or 3.3 per cent., perforated through the cystic duct, 4, or 4.4 per cent., through the com-

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mon duct, while but 1, or 1.1 per cent., perforated through the hepatic duct.

3. Calculi are a great factor in causing perforation, for in 80 out of 108 cases, or 74 per cent., stones were found at the time of the operations. In 14 cases, or 13 per cent., it was found that no stones were present after adequate search. In the 14 remaining cases, or 13 per cent., stones may or may not have been present as no mention is made of them.

4. In but 9 cases is it distinctly stated that gangrene was present.

5. Of 99 patients whose ages are given, the average was 50 years. Before 50 years, there were 44 cases with 63 per cent. of recoveries, while beyond 50 years there were 55 cases with 46 per cent. of recoveries. Between 50 and 60 years, there were 35 cases with but 14 recoveries.

6. Sixty-two of the cases occurred in women, or 60 per cent., and they stand the disease better than men, the mortality in women being 44 per cent. as against 54 per cent. in men.

7. Of 108 cases operated upon, 56 recovered, or 51 per cent., while 52 died, or 48 per cent. This is in contrast to the 28 traumatic ruptures, reported by Rickets, operated upon with 22 recoveries, or 78 per cent. The difference is due to infection.

8. Early operation, as in all forms of peritonitis, is the best guarantee of success; thus, of 7 cases operated upon within 12 hours of the perforation 6, or 85 per cent. recovered; of 15 operated upon within one day of the perforation, 10, or 66 per cent. recovered; of 14 within 2 days, 7 recovered, or 50 per cent.; of 16 operated upon within 3 days of the perforation, 8 recovered, or 50 per cent.; while of 10 cases that had gone 4 days before operation only 2 recovered, or 20 per cent.

9. Suture of the perforation is to be unhesitatingly condemned. Four out of 5 cases thus treated died. Simple incision of the abdomen with drainage of the biliary region gave 47 per cent of recoveries. With cholecystectomy 48

per cent. recovered. The best results were obtained with cholecystostomy, with which 61 per cent. recovered.

ABSTRACT OF 108 CASES OF BILIARY PERFORATION FROM LITERATURE.

Case 1 (Von Arx): Female, 48; colics for 2 months, acute for 20 hours; perforation at neck, free bile. Suture of perforation. Cholecystostomy. Recovered. One calculus in gall-bladder.

Case 2 (Baldwin): Female, 50; colics for years, symptoms for one day; perforation in body, free bile. Cholecystostomy. Recovered. Six calculi in gall-bladder.

Case 3 (Baldwin): Male, 55; indefinite colics four days; perforation in body, gangrene. Cholecystectomy. Died. Several calculi in gall-bladder.

Case 4 (Baldwin): Male, 27; symptoms three years, colic two days; perforation in fundus, extensive adhesions. Cholecystectomy. Recovered. Twelve calculi in gall-bladder.

Case 5 (Brunner): Female, 56; symptoms one year, colics not stated; perforation of hepatic duct, abdomen full of bile. Tamponade only of abdomen. Died. Stone in ampulla and two in common duct.

Case 6 (Brunner): Female, 50; stomach symptoms 24 hours; gall-bladder perforated, abdomen full of bile. Cholecystectomy. Died. Calculi in gall-bladder.

Case 7 (Czerny): Female, 61; symptoms five days; perforation of gall-bladder, gangrene; abdomen contained bile. Partial cholecystectomy and suture; abdominal drain. Died. Calculi in gall-bladder.

Case 8 (Delageniere): Perforation of gall-bladder and gangrene. Cholecystectomy. Died. Calculi in gall-bladder.

Case 9 (Finck): Male, 54; symptoms three days; perforation of gall-bladder. Tamponade only. Recovered.

Case 10 (Hallet): Female, 45; colics one day; perforation of gall-bladder. Cholecystostomy. Recovered. Four calculi free.

Case 11 (Hallet): Female, 50; colics fifteen hours; pressure perforation at fundus, free bile. Cholecystostomy. Recovered. Numerous calculi in gall-bladder.

Case 12 (Hartig): Female, 42; symptoms four days; perforation of gall-bladder twice, free bile. Cholecystostomy twice. Died. Calculus in gall-bladder. Two operations.

Case 13 (Hartig): Male, 62; previous colics; perforation of gall-bladder, free bile. Cholecystostomy. Recovered. Perforation over calculus.

Case 14 (Hartig): Female, 53; symptoms six days; perforation in fundus, adhesions. Cholecystectomy. Died. Three calculi in gall-bladder.

Case 15 (Hirschel): Female, 27; symptoms two days; perforation in fundus, localized. Cholecystostomy. Died. Several great calculi.

Case 16 (Hirschel): Male, 57; symptoms four days; perforation near neck by pressure. Cholecystostomy. Died. Single calculus; pulmonary gangrene on eleventh day.

Case 17 (Hirschel): Female, 59; perforation; suture of perforation. Died. Stones not stated; death from pneumonia.

Case 18 (Hochenegg): Female, 45; symptoms 12 hours; perforation at middle; suture of perforation. Cholecystostomy. Recovered. Diagnosis, intestinal obstruction; stones present.

Case 19 (Jaboulay): Male, 66; symptoms two years, colics three days; perforation. Cholecystostomy. Died. One calculus; great.

Case 20 (Jenckel): Female, 45; symptoms three days; perforation at summit. Tamponade only. Died. Stone not stated.

Case 21 (Aurray): Female, 48; symptoms 12 hours; perforation of neck. Suture of perforation. Died. General peritonitis; stones present; no jaundice.

Case 22 (Kehr): Female, 51; symptoms four days; perforation of common duct. Cholecystectomy. Died. Calculi in common and hepatic ducts; perforation of common duct; jaundice.

Case 23 (Konig): Female, 70; symptoms two days; perforation by pressure of gall-bladder. Cholecystectomy. Recovered. Diagnosis, invagination of intestines; calculi numerous.

Case 24 (Korte): Male, 56; colics five days; several perforations in gall-bladder. Cholecystectomy. Recovered. Diagnosis, intestinal obstruction; large calculus; intestinal cavity washed.

Case 25 (Korte): Female, 37; colics three days; several perforations in gall-bladder. Cholecystostomy. Recovered. Calculi present; no jaundice.

Case 26 (Korte): Female, 30; colics three days; perforation of gall-bladder. Cholecystectomy. Recovered. Calculi at entrance of cystic duct.

Case 27 (Korte): Female, 72; perforation of gall-bladder. Cholecystostomy. Recovered. Several calculi; secondary ectomy two months later.

Case 28 (Korte): Female, 63; symptoms four days; perforation of gall-bladder. Cholecystectomy. Died four weeks after operation of embolism; one calculus.

Case 29 (Korte): Female, 51; perforation of cystic duct; drainage in common duct, also cystic duct. Cholecystostomy. Died. Calculi in common and hepatic duct. None in gall-bladder.

Case 30 (Korte): Male, 30; symptoms five days. Tamponade, incision only. Died. Stones not mentioned.

Case 31 (Korte): Female, 56; symptoms five days; perforation of gall-bladder. Tamponade, incision only. Died on eighteenth day after operation.

Case 32 (Kummel-Goldammer): Male, 57; symptoms two days; perforation of fundus, free bile. Cholecystostomy. Died. Calculi present.

Case 33 (Kummel-Goldammer): Female; symptoms three days; free bile. Cholecystostomy. Died. Calculi present; death after a number of days.

Case 34 (Kummel-Kammerer): Female, 33; gangrene with perforation. Cholecystostomy. Recovered. Calculi present.

Case 35 (Kummel-Kammerer): Male, 65; gangrene with perforation. Cholecystostomy. Died. Calculi present.

Case 36 (Kummel-Goldammer): Male, 54; gangrene with perforations. Died.

Case 37 (Kummel-Goldammer): Female, 50; symptoms two days; empyema and perforation. Died. Numerous calculi.

Case 38 (Kuster): Female, 57; symptoms 28 hours; perforation from pressure of calculi. Closure of perforation. Died. Calculi present.

Case 39 (Lecene): Female, 62; symptoms three days; perforation at fundus. Cholecystostomy. Recovered. Single calculus; second operation two months later; cholecystectomy.

Case 40 (Maire): Male, 36; symptoms ten days; perforation of gall-bladder, free bile. Cholecystectomy. Died. Icterus present; cholecystitis; calculus in ampulla removed; hepatic drainage.

Case 41 (Martens): Female, 58; symptoms three days; perforation of cystic duct, gangrene from pressure. Cholecystectomy. Died from pneumonia; calculi present.

Case 42 (Marwedel): Female, 27; symptoms two days; perforation of gall-bladder. Cholecystostomy. Died. Numerous calculi.

Case 43 (Meriwether): Female, 62; symptoms one day; perforation of gall-bladder by pressure. Cholecystostomy. Recovered. No calculi.

Case 44 (Meriwether): Male, 80; symptoms five days; perforation of gall-bladder. Tamponade only. Died. Numerous calculi.

Case 45 (Von Mosetig-Moorhof): Male, 59; symptoms four days; perforation of gall-bladder at fundus. Cholecystostomy. Recovered. Several calculi.

Case 46 (Neck): Female, 43; symptoms three days; perforation of gall-bladder at summit. Cholecystostomy. Recovered. Numerous calculi.

Case 47 (Newbolt): Female, 48; symptoms two days; perforation of gall-bladder; gangrene; suture of perforation and of abdomen. Died. Stones removed; one impacted in cystic duct. Diagnosis, perforation of gastric ulcer; no jaundice.

Case 48 (Nordmann): Female, 49; tamponade only. Recovered. Stones not stated.

Case 49 (Nordmann): Female, 21; symptoms one day; perforation of gall-bladder, free bile. Cholecystectomy. Recovered. Drainage of common duct; numerous stones; numerous abscesses in gall-bladder wall.

Case 50 (Riedel): Female, 74; symptoms 36 hours; perforation of fundus. Cholecystectomy. Died. Single large stone in neck.

Case 51 (Riedel): Female, 55; symptoms seven days; perforation at fundus. Cholecystectomy. Died. Numerous calculi.

Case 52 (Riedel): Male, 56; symptoms three days; perforation of gall-bladder and of common duct. Cholecystostomy. Died. Pigeon's egg calculus in common duct; hepatic drainage, also Douglas.

Case 53 (Routier): Female, 56; symptoms one day; perforation of common duct, free bile. Cholecystostomy. Recovered. Numerous stones, secondary ectomy.

Case 54 (Schnitzler): Female, 55; symptoms five days; perforation of gall-bladder, gangrene. Cholecystectomy. Recovered. One stone; jaundice.

Case 55 (Schonborn): Female, 50; symptoms three days; abdomen alone drained, free bile. Tamponade of abdomen only. Recovered. No stones found.

Case 56 (Straetter): Female, 63; symptoms five days; perforation of gall-bladder. Cholecystostomy. Recovered. Numerous stones.

Case 57 (Thiel): Female, 59; symptoms three days; perforation of fundus. Cholecystostomy. Recovered. One large stone.

Case 58 (Torrance): Male, 59; symptoms four hours; perforation of gall-bladder, free bile. Cholecystectomy. Recovered. Gastro-enterostomy, appendectomy; stones not stated.

Case 59 (Ullmann): Male, 42; symptoms six days; perforation from pressure of stone in gall-bladder. Cholecystectomy. Died. Numerous calculi, one in cystic duct; no jaundice.

Case 60 (Ullmann): Female, 53; symptoms twelve hours; perforation of gall-bladder, free bile. Tamponade only. Recovered. Numerous stones; no jaundice.

Case 61 (Verral): Female, 44; symptoms four days; perforation of fundus; suture of gall-bladder. Recovered. Numerous calculi.

Case 62 (Villard): Female, 35; symptoms three days; perforation of gall-bladder. Tamponade only. Died. Numerous calculi.

Case 63 (Weigel): Male, 45; symptoms one day; perforation of fundus, free bile. Cholecystostomy. Died. Calculi removed from cystic duct and gall-bladder.

Case 64 (MacLaren, Case III): Male, 50; symptoms ten days; perforation on anterior wall. Cholecystostomy. Recovered. No stones.

Case 65 (Vaughan): Male; symptoms three days; perforation of gall-bladder; drainage of abdomen only. Died. No stones; developed during typhoid and operation for supposed perforation.

Case 66 (Rixford): Male; symptoms two days; perforation at fundus. Cholecystectomy. Recovered. Aseptic perforation; numerous calculi in gall-bladder.

Case 67 (Haggard): Male; perforation of gall-bladder. Drainage of abdomen only. Recovered. Stones free in abdomen.

Case 68 (Moynihan): Male, 46; symptoms eleven days; perforation at fundus, free bile. Cholecystostomy. Died. Seven stones in gall-bladder.

Case 69 (Walker): Male, 27; symptoms three days; perforation at fundus by pressure, free bile. Cholecystectomy. Recovered. Numerous stones; one large one by pressure caused perforation.

Case 70 (MacLaren, Case VIII): Male, 45; symptoms two weeks; perforation at fundus; enormous abscess with bile. Cholecystostomy. Recovered. Stones removed at secondary operation; subdiaphragmatic abscess opened; jaundice present.

Case 71 (MacLaren, Case IX): Female, 31; symptoms ten days; perforation at fundus; large abscess and stones. Tamponade only. Recovered. Jaundice.

Case 72 (MacLaren, Case X): Female, 32; large abscess with stones.

Cholecystostomy. Recovered. Followed on typhoid; secondary cholecystostomy with removal of stones.

Case 73 (Ferguson): Female, 35; perforation at fundus, free bile. Cholecystostomy. Recovered. Several stones; jaundiced.

Case 74 (Noetzel): Male, 52. Cholecystectomy. Died. Stones not stated.

Case 75 (Noetzel): Male, 63. Cholecystectomy. Died. Stones not stated.

Case 76 (Noetzel): Female, 62. Cholecystectomy. Died. Stones not stated.

Case 77 (Noetzel): Female, 65. Cholecystectomy. Recovered. Stones present.

Case 78 (Noetzel): Female, 59. Cholecystectomy. Died. Stones not stated.

Case 79 (Noetzel): Female, 23. Cholecystectomy. Recovered. Single stone present.

Case 80 (Narath): Male, 59; symptoms four days; perforation of gangrenous spot, free bile. Cholecystostomy. Died from pulmonary gangrene. One stone in gall-bladder.

Case 81 (Kranze): Age 67; symptoms two days; perforation at fundus, free bile. Cholecystostomy. Recovered. Diagnosis before operation, volvulus; no stones.

Case 82 (Kranze): Age 70; symptoms six days; perforation at neck, free bile. Cholecystostomy. Recovered. No stones.

Case 83 (Neupert): Female, 42; symptoms 14 hours; perforation of common duct at juncture with cystic duct, free bile. Cholecystectomy. Recovered. Jaundice; acute impaction of stone in common duct. Removed.

Case 84 (Whitacre): Male, 72; symptoms 12 hours; no stones; perforation of gall-bladder, free bile. Cholecystostomy. Recovered. No stones; no jaundice.

Case 85 (Whitacre): Female, 42; symptoms one week; fundus perforated, free bile. Cholecystostomy. Recovered. Many stones in gall-bladder; no jaundice.

Case 86 (Whitacre): Female, 26; first operation 24 hours, second operation 27 hours; perforation in fundus, free bile. Tamponade only in both operations. Recovered. Three operations; two first were cholecystostomies, third was cholecystectomy; two perforations at different times; gallstones present in gall-bladder; jaundice not mentioned.

Case 87 (Whitacre): Male, 58; symptoms two days; perforation in fundus, free bile. Cholecystostomy. Recovered. Stones in gall-bladder; no jaundice.

Case 88 (Whitacre): Female, 50; symptoms one day; free bile. Tamponade only. Died. Stones not stated; no jaundice.

Case 89 (Whitacre): Female, 28; symptoms several days; free bile. Tamponade only. Recovered. Stones not stated; no jaundice.

Case 90 (Kiliani): Male, 40; symptoms four weeks; two perforations

in fundus. Cholecystectomy. Died. Two small perforations of ileum found; two stones present.

Case 91 (McWilliams): Male, 67; symptoms one day; perforation in fundus, immense pocket of bile. Cholecystostomy. Recovered. Diagnosis, intestinal obstruction or appendicitis; two incisions; no jaundice; stone removed.

Case 92 (McWilliams): Male, 38; symptoms three days; perforation of cystic duct. Cholecystostomy. Died. Diagnosis, appendicitis; two incisions; stone present.

Case 93 (Dr. Brown): Male, 49; symptoms two weeks; perforation at fundus. Cholecystostomy. Recovered. One stone removed.

Case 94 (Dr. Blake): Male, 49; symptoms two days; perforation at fundus, no adhesions, free pus. Cholecystectomy. Recovered. Many stones; general abdominal irrigation.

Case 95 (Dr. Hawkes): Male, 31; symptoms four days; large abscess, adhesions. Tamponade only. Died twenty-one days after operation. No stones; jaundice present.

Case 96 (Dr. McCosh): Male, 26; adhesions about gall-bladder, gangrene, bile, and pus. Cholecystectomy. Recovered. No stones; jaundice present.

Case 97 (Roersch): Female, 67; symptoms one day; perforation of gall-bladder, free bile. Cholecystostomy. Died. Operation for intestinal obstruction; single stone present.

Case 98 (Erdmann): Female, 46; symptoms 12 hours; perforation of gall-bladder, free bile. Cholecystostomy. Recovered. Diagnosis, intestinal perforation; stones present in gall-bladder; typhoid present.

Case 99 (Jopson): Female, 51; symptoms 72 hours; perforation not located, free bile. Cholecystostomy. Recovered. Stone impacted in cystic duct; jaundice present.

Case 100 (Fritz-Koenig): Female, 70; symptoms two days; perforation at fundus. Cholecystectomy. Recovered. Numerous stones; jaundice.

Case 101 (Williams and Sheidd): Male, 31; perforation of gall-bladder. Tamponade only. Recovered. During typhoid, no stones.

Case 102 (Adám): Female; perforation of gall-bladder. Cholecystostomy. Died. Stones not mentioned.

Case 103 (Adám): Cholecystostomy. Died. Stones not mentioned; jaundice present.

Case 104 (Adám): Cholecystostomy. Died. Stones not present; jaundice present.

Case 105 (Mayo-Robson): Male, 45; several pints of bile and pus. Cholecystostomy. Recovered. Stones not mentioned.

Case 106 (Mayo-Robson): Female, 47; symptoms six days; perforation of fundus. Cholecystectomy. Recovered. Several stones removed; deeply jaundiced.

Case 107 (Gordon): Male, 50; symptoms four days. Tamponade only. Died. Calculi present; jaundice present.

Case 108 (Grant): Male, 53; symptoms 15 hours; quart of bile. Tamponade only. Died. Diagnosis, appendicitis; no stones; no jaundice.

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THE ERROR OF OVERLOOKING URETERAL OR RENAL STONE UNDER THE DIAGNOSIS OF APPENDICITIS.

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THE diagnosis of appendicitis, after the enormous experience of the past twenty-five years, admits of little if any improvement either in method or in results. Occasionally, nevertheless, I meet with considerable difficulty in recognizing appendicitis with accuracy, or differentiating it from other rare lesions that may closely resemble it. The more I see of this disease, the more I am impressed by my ignorance of it. I cannot help recalling the positive conclusions to which I came after my first five cases. Indeed, now that my cases have risen into the thousands, I find that facts of great importance, especially in connection with the diagnosis, are constantly coming out—facts that in the beginning were never even suspected. Moreover, judging by the post-operative and unbenefited cases that come to me with symptoms and complications which the operator had apparently never suspected or understood, I feel that there may be others beside myself who occasionally overlook the real cause of symptoms and complications. For example, I may mention a left-sided tuberculosis (so it was diagnosticated, operated upon, and abandoned, in Manitoba), which proved to be a chronic appendicitis following an acute perforative localized peritonitis. The patient was cured by removal of a thickened, scarred, and cheesy appendix.

In another case—that of a young man—I found a much-diseased appendix causing symptoms and physical signs which made a genito-urinary specialist fear tuberculosis of the blad-

der and a medical internist fear cancer of the lower sigmoid; and yet the diagnostic skill of these men was of the highest, and their experience of the broadest. I had the same fears, but felt a strong hope that the lesion was an unusual form of appendicitis. This proved to be the case, and removal of the appendix restored the patient to health. Not a few instances have come to my attention in which similar error has occurred, and I have no doubt that others have been able to make in my cases, abandoned as hopeless and inoperable, an occasional brilliant diagnosis of the real condition of the appendix, and to accomplish complete operative cure.

A very puzzling case was one in which, under the diagnosis of appendicitis (which was correct), operation had been undertaken and abandoned. The operator could not find the appendix. Some months later, as the symptoms continued, I undertook the operation in a confident spirit, only to find myself searching in vain for the appendix through the right half of the abdomen. As there was no cæcum in the right iliac fossa, I carried my incision high enough to explore the region of the gall-bladder, duodenum, and right kidney; but no sign of cæcum or appendix could there be found. My assistant finally observed that the sigmoid flexure started in the right iliac fossa, that, in fact, the viscera were transposed, and that the appendix was in the left iliac fossa, easily accessible through the unusually long incision that I had made.

I will not speak of cases of salpingitis, ovarian tumor with twisted pedicle, extra-uterine pregnancy, cancer of the ileo-cæcal valve, tuberculosis of the cæcum, psoas abscess, perforation of the stomach or duodenum, strictures of the duodenum or jejunum from unsuspected malignant disease, gall-stones, and cholecystitis, as well as many other organic lesions that I have mistaken for appendicitis. My subject—stone impacted in the right ureter and simulating appendicitis so that the operator has been deceived—seems to me, from its frequency and from the ease with which the truth may be demonstrated, worthy of special consideration.

The number of my cases in which appendicitis has been

mistaken for a urinary calculus or a urinary calculus mistaken for appendicitis is not large, including the cases operated upon and unoperated upon, in the diagnosis of which a successful differentiation was made before operation. I have collected them all for this paper; but I may not have recognized all there were. In several the surgeon who removed the appendix never knew that the symptoms were due to ureteral calculus, and in some of my own I was at first deceived. How many cases I have operated on by taking out the appendix, with recovery from the operation and synchronous subsidence of ureteral symptoms, I do not know. I dare say that there have been several, judging from the frequency of ureteral stones in my cases since I began systematic search for them. Judging from some of the cases, a stone impacted in the ureter may stay there indefinitely, without any symptoms whatever, after subsidence of those of the original attack. That I have had at least one case like this I know; that there have been others, operated upon and unoperated upon, without knowledge of the true pathology, I am quite prepared to believe.

One object of this paper is to show how easily one may be deceived; another is to show how easily one may escape error.

I look upon the multiplication of appendectomies with complacency, and without any especial objection beyond that of inadequate indications for even this, one of the safest of operations. Except in the highly imaginative and neurasthenic, I do not think unnecessary appendectomy is likely to do any harm in the hands of those well fitted to perform abdominal operations. The *furor operandi*, a few years ago directed against the ovary, has been transferred to the appendix. But in the efforts to find and remedy the cause of abdominal pain, removal of an apparently normal appendix is attended with many beneficent results. I have no doubt whatever that many appendices apparently normal are really dangerous to health and life. How many serious attacks of appendicitis and peritonitis have been prevented by the numerous appendectomies, there is no means of telling. That

pain, discomfort, and fever are permanently relieved, I know. I am beginning to see the benefits of normal appendectomies performed in the course of other abdominal operations, for in several cases other causes for peritonitis have been recognized, in the known absence of an appendicular cause. Furthermore, in the case of several patients I have been obliged to operate for acute appendicitis because I had not removed the appendix when it could have been removed easily and safely during some previous abdominal operation for other lesions.

It is the wide-spread belief in the value of appendectomy that makes us perhaps careless in our indications, and especially that indication which rests upon an accurate diagnosis. If we say that in the hands of good surgeons removal of the appendix is likely to do the greatest amount of good at the least exposure of danger and suffering, I admit the truth of this statement, but only when, by the elimination of other causes of pain and discomfort, we are as sure as we can be that we are not mistaking for an appendicular cause some other and more serious disease.

I am about to consider the ureteral stone as a not infrequent "other cause"; but there are, I am sure, many other lesions which are and will be overlooked unless we search diligently for them.

My most recent illustration of these remarks—not twenty-four hours before these words were written—is the case of a girl of three, with menacing symptoms of intestinal obstruction. A year ago a surgeon, operating for abdominal symptoms diagnosticated by the highest authority as appendicitis with abscess, found a slightly affected appendix, without abscess, but with a chain of enlarged lymph-glands from the ileocæcal coil to the receptaculum chyli. I found general peritonitis with no cause other than a broken-down gland in the ileocæcal coil. This case shows that the symptoms of appendicitis may arise from inflamed lymph-nodes, and that the previous removal of a prolific cause of peritonitis simplifies much the diagnosis. Its chief application is toward a careful

search for causes other than appendicitis before appendectomy is undertaken.

I wish here to record again my belief and practice in the utmost care in diagnoses upon which depend even trivial operations. Indeed, the safer the operation and the less sure its necessity, the greater the pains to be taken. Abdominal and other operations are performed upon the diagnosis of others; sometimes even upon the patient's own. I have seen too many operations introduced with a remark like this: "The patient is said to have appendicitis. I have not examined her." True, in most instances the operation is necessary; but were all efforts made and precautions taken there would be little occasion to write upon subjects like that of this paper.

A young woman, a stenographer, to whom an operation and its cost were of the utmost importance—much greater than they are in the case of the idle rich—came to me and said: "I am afraid I have appendicitis, and I wish to know. I consulted a surgeon, and said, 'I have pain in my right side and I am afraid I have appendicitis.' He reached over his desk as I sat opposite, touched my side, outside of my clothes, corsets and all, and replied, 'Yes, you have. I will operate in the morning.'" This patient was unwilling to be operated upon after such an examination, and came to me.

It took me a long time to make up my mind in this case, for I had suspicions that the pain might be from a ureteral stone, an ovary, constipation, colitis, movable kidney, or neurasthenia. But, in the end, I came to the same conclusion that the other man did after reaching over his table and touching the girl's dress. I removed an appendix that looked as most slightly offending appendices look. The patient was cured of her pain.

Now, it is in these cases that the rarer causes of abdominal pain are overlooked. Discredit is brought upon surgery; and, worst of all, that discredit is deserved.

The surgeon in his practice is confronted by the greatest possible variety of abdominal pain, especially in women. It

seems to me safe to say that without pain of some sort, at some time, the diagnosis of chronic appendicitis is impossible. It is quite conceivable that an infection of the appendix, the result of an acute process, may exist, quiescent, without pain or even discomfort; but there must have been at some time pain of some kind. The tenderness without pain is much less indicative of an affection of the appendix than pain without tenderness. I often find a tender, appendix-like body slipping under the fingers in the left iliac fossa. Such an object in the right iliac fossa I should unhesitatingly call a tender appendix, and, with pain, deduce an appendicitis. In the left iliac fossa it is of course not the appendix. If anything more than the edge of the colon, muscle border, or tendon or nerve, it may mean a ureteral stone, and this suspicion should indicate an X-ray examination, when, if the tenderness were on the other side, the diagnosis of appendicitis would be reasonably clear. But even on the right side these symptoms should indicate an X-ray search, with or without red blood-cells in the urine. Without some attribute of pain, neither the appendix nor a calculus need receive serious consideration.

When there is real pain without constitutional signs, my suspicions are directed toward a possible urinary stone by paroxysms of more than usual violence. Even when appendicular colic is strongly suspected, intermittence suggests other than an appendicular source of pain. A severity requiring opiates or anything more than external applications, without fever, distention, vomiting, or other signs of beginning peritonitis, suggests stone.

In many of the cases we have no opportunity of judging the pain, for we get only the patient's history of it. In a recent case there were violent recurring attacks so suggestive that I made the diagnosis by the history alone. Dr. Dodd found by X-ray "a stone in the ureter near the bladder."

The kind of pain in chronic appendicitis seems to me to differ from that pain so characteristic of renal colic. To weigh the significance of pain in renal colic, we must go back to its beginning, to the spasm of its first engagement in

the ureter, for the pain of an old impacted stone may be slight. Not so the pain in the early days of impaction. When the stone is first impacted, the pain is so great that words can hardly describe it. Nothing but morphia or general anæsthesia will control it. A stone caught and held immovably in the ureter, indescribable as is at first the agony that it causes, after a few hours or days, like the gall-stone hopelessly impacted in the common duct, no longer causes pain. There may be even no discomfort whatever. The acute spasm, the unbearable agony, are gone; the muscular spasms no longer continue in their original violence.

But there is one physical sign that always arouses or confirms the suspicion of ureteral stone. Blood in the urine, if only microscopic, is a symptom which should always demand an X-ray examination, though I have it made whenever anything in the history, no matter how trivial, arouses the suspicion of stone.

The diagnosis of ureteral stone simulating appendicitis is exceedingly easy and positive. It is made so by the X-ray, without which it could never be made with certainty. True, by ureteral catheterization scratches upon a waxed ureteral bougie, as Kelly suggests, almost prove the presence of a stone. But with the X-ray much more information can be obtained, and without pain or danger. The diagnosis is easy once a stone is suggested or suspected. The stone is overlooked, not because the diagnosis is difficult, but because the presence of the stone is not even suspected.

We all know but we do not always realize the fact that we overlook pathological conditions easy of diagnosis because we do not happen to think of them. The minute the right but overlooked possibility has been suggested, one pounces upon the diagnosis—every symptom in the history and physical examination will fit into and prove that diagnosis.

This statement is particularly true of ureteral stone; the surgeon is so impressed by the truth that he wonders he did not think of it before. The previous history of renal pain or distress, the intermittent attacks, the gradual shift of situa-

tion, the direction of the pain, and last, but most important, blood, even if in microscopic quantities—such symptoms suggest calculus and the X-ray examination. Skilful examinations by experienced X-ray men, controlled by repetitions with a ureteral instrument *in situ*, demonstrate the truth as absolutely as it can be demonstrated in surgical diagnosis.

With such precautions, error in diagnosis, which some years ago seemed to me at times quite unavoidable, is practically beyond serious consideration.

It is not so very important to make out beyond a question the exact diagnosis in acute abdominal emergencies,—at least it is not absolutely essential, because, whatever the pathological lesion may be, the conditions are such that it is without doubt necessary to explore. Not that an accurate diagnosis will not be somewhat of an advantage as guiding the surgeon directly to his lesion; but in emergencies, time is always of such great importance that to spend it in attempting the impossible, when a stroke of the knife will make the diagnosis sure, is the worst of folly.

And yet there have doubtless been many unnecessary and perhaps fatal explorations which a little more careful study of the cases might have prevented: appendectomies and other explorations in typhoid fever; search for acute lesions that did not exist, such, for example, as the search for the cause of intestinal obstruction in the obstipation and pain of lead colic; search for blood when there was no blood; operation for extra-uterine pregnancy when the pregnancy was normal. There has been search throughout the left upper quadrant when the lesion was in the right lower; search for a mechanical cause of intestinal obstruction when there was the *ileus paralyticus* of peritonitis; for duodenal ulcer in cancer of the jejunum; for gall-stones in pancreatitis; for a host of possible lesions remote from a simple gangrenous appendicitis,—in a word, search everywhere but in the right place.

Scattered through my records are cases illustrative of all these things. In explorations shown to be unnecessary—in spite of that fact—the results have been recovery from the

exploration, and, in many cases, perhaps through the suggestive effect of the operation *per se*, the patient has been restored to health. When really serious lesions have been found, but only after prolonged search, that loss of time has always added to the danger and increased the mortality. In most emergencies, however desirable the exact diagnosis, there is not much time to study the exact pathology. The surgeon should, however, employ the brief time at his disposal to be as accurate as the case and his experience will permit. Errors, whether of diagnosis or of operation, will occur notwithstanding his care. They will not necessarily result from his want of care.

The whole aspect of the question is changed in chronic conditions. Then there is time in abundance to study the patient from every point of view. If diagnosis is humanly possible, then the diagnosis ought to be made, or, if not made, the reason why it is not made should be shown. I, for one, am tired of seeing abdomens opened for one thing when something else is found; and yet no one knows better than I do the limitations of human skill in diagnosis. As I write these words at the Vincent Hospital, are not my assistants putting to bed a woman in whose case I was sure, both before and after anæsthesia, of the diagnosis of uterine fibroid, and from whom I have just taken a tense, adherent, right-sided ovarian tumor? I claim for myself at least an ordinary skill in the interpretation of abdominal symptoms, and in the digital examination. But, as I have said in other papers, there are certain differentiations in abdominal surgery that cannot be made with certainty, and that between the fibroid and certain other pelvic tumors is one of them. We know it and admit it. Therefore, when an error like this is made, we have discounted the limitations. In all error the sting lies in carelessness, heedlessness, ignorance—in failures even to suspect the truth.

I am quite convinced that too little attention is paid to the diagnosis of chronic appendicitis. So long as there is pain or discomfort anywhere near the appendix, chronic organic

disease is diagnosticated and the appendix is removed. I am not opposed to the removal of the appendix when it is diseased; I even favor its removal when apparently normal, if it is easily accessible during other abdominal operations, for I believe that it is a threat to every life, no matter how innocent it looks.

When, however, it is proposed to open the abdomen for the special purpose of seeking and removing the appendix, that is an entirely different matter. Then it is necessary for the surgeon to be as sure as possible that he is on the right track; that it is indeed the appendix that is giving trouble and not some other organ. The exploration is therefore not to be undertaken until all methods of diagnosis are exhausted.

It is here, I believe, that criticism of modern methods is indicated,—I mean the too hasty conclusion that it is always the appendix that is at fault,—criticism of the inadequate history, the superficial examination, the unfulfilled indications for operation.

In my opinion, the less clearly necessary the operation, the more clearly necessary the careful study of the history, physical examination, and contraindications; for the less justifiable the operation, the greater the disaster in case of failure. The greater the haste, the more bitter the repentance. The more neglected the contraindications, the harder to bear the failure.

I am not addressing the occasional operator so much as the expert in abdominal surgery and diagnosis. I have said elsewhere perhaps too much about the wrong done humanity and the science and art of surgery by those who undertake abdominal surgery without adequate preparation for its great difficulties and responsibilities. I do not expect such operators to avoid even the most glaring mistakes, the most disastrous blunders, for they are not qualified either by education or by experience to avoid them.

My first experience of ureteral stone simulating appendicitis occurred some years ago in the practice of a colleague who asked me to see a patient in the next room upon whom

he was operating, and in whom, instead of a chronic appendicitis, he had found a stone impacted in the ureter just above the sacro-iliac synchondrosis. I had never met with this lesion in suspected appendicitis, but soon after a similar experience in my own practice emphasized its possibility. I have been on the lookout for this source of error in chronic appendicitis, and have found in my records two dozen cases more or less, in which the diagnosis of stone in the ureter was made, but in which there was strong doubt as to that diagnosis until it was confirmed either by the X-ray or by operation. In the early cases the diagnosis of stone was strongly suspected, but no stones were found, as no operation was deemed necessary under the diagnosis of acute appendicitis. The patients recovered and were lost sight of. In all the later cases the suspicion of stone led, through X-ray investigation by an expert, to a demonstration which in most instances operation confirmed.

As my records approach the year 1911, the cases under consideration increase. Of the twenty-four (and I have no doubt that several cases have escaped my search) five have been operated on after correct diagnosis, in 1911. The question of ureteral stone has come up in several other cases of suspected appendicitis, but that possibility has been eliminated by the X-ray. The diagnosis of ureteral stone seems, therefore, of considerable practical importance.

In my experience the occurrence of ureteral stone, though not unusual at the present time, is very much more common than it used to be; it is common enough, now that my attention has been directed to the possibility of error, to make me think that in the past I must have overlooked not a few times this cause of abdominal pain, and have removed the appendix without even suspecting the real cause. What became of these cases I do not know; it does not seem likely that all these appendectomies failed to relieve recurring pain without that fact in some way coming to me. It is not because I have written upon the subject that physicians are now sending me cases, for I have published nothing upon it. The reason why

I have found so many cases is that I have looked for them. I remember some years ago, before the X-ray was much used, that I was called to cases of supposed appendicitis which I believed to be cases of renal stone, and upon which I did not operate. One or two patients with pain in the right abdomen under the scar of an appendectomy suggested a ureteral stone. These cases I have not included in this paper, for the diagnosis was not proved. From all my available cases in which the diagnosis is unquestioned, I select a few for illustration.

The first case, briefly abstracted, is that of F. W. A., a physician very familiar with appendicitis, who, with the physician attending him, made a diagnosis of acute appendicitis—a diagnosis that was confirmed by Fitz and myself. This patient I saw on Thursday, February 13, 1908. The first symptom was on Monday, and resembled so much a colic that the patient had had fifteen years before that he supposed it came from the same transitory cause. The pain stayed in the same place all Monday night. It was moderately severe. Morphia hypodermically relieved the pain. The bowels were constipated, and all Tuesday was spent in trying to move them. A profuse movement resulted Tuesday night. Pain became localized in the right groin Tuesday. There were two tender places low down in the right iliac fossa. Both testicles were drawn up. Catheterization was necessary. The pain became agonizing, and morphia had no effect upon it; ether alone controlled it. At the attack twenty years before there was no suspicion of a renal cause. There were two or three attacks of colic in the right side of the abdomen. The attacks came on with vomiting, and would leave for a day or two a soreness in the right side. With the vomiting there would be a sharp pain, so intense as to make him faint. Since then there have been no attacks of colic.

There were signs of local peritonitis at the pelvic brim, perceptible by external and by rectal examination. The temperature was not over 100°. The diagnosis was acute appendicitis of moderate severity, with local peritonitis. The patient decided to await developments, and continued in about the same condition. On February 25 the local signs were much less, and the patient very comfortable. The temperature dropped to 99°.

In this case we felt sure of an appendicular origin, but there was a suggestion of renal colic in the history, which, in spite of the local signs in the right iliac fossa, led to an X-ray examination as soon as the patient could leave his bed. A shadow about the size of an almond was found at the level of the sacro-iliac synchondrosis. The advisability of searching for the stone, after proving the diagnosis by ureteral catheterization, was considered, but the patient, wisely, as the event proved, decided to await developments. His view of the case is shown by a letter written three years later (in August, 1911): "I am practically free from disturbances of any kind. An occasional grumble in the abdomen is almost always proven to be intestinal in origin. There is no tenderness over the site of the stone; absolutely no bladder or urinary symptoms of any kind. Micturition is normal in quantity and frequency, and the urine is negative to examination. I weigh 205 pounds; rode in the automobile last year 13,500 miles, over all sorts of roads, with no disturbance or trouble. The last radiograph was taken over a year ago. At that time there was practically no change in the position or size of the calculus. As I look back it is my belief that this calculus has existed in its present location for over twenty years."

This case is used to illustrate the error of diagnosis rather than the treatment of ureteral stone. It is interesting to see that the stone remained thus impacted without causing disability of any kind. One cannot hope, however, often to see so fortunate an ending.

A somewhat similar case is that of Mrs. S., aged forty-five, who was taken suddenly on Saturday with pain in the abdomen, followed by distention. There had been constipation for four days. With the pain and distention there was vomiting. On Sunday the pulse and temperature were up a little. Monday morning the temperature was 102° ; at night 103° . At no time was there any rigidity in the right side. A mass could be felt in the right lower quadrant; it could be outlined very accurately by bimanual examination. In this case the diagnosis lay between appendicitis with abscess and pyosalpinx. There had never been any abdominal symptoms before. There was no loss of weight. In the diagnosis appendicitis, salpingitis, inflamed ovarian cyst,

cyst with twisted pedicle, extra-uterine pregnancy, and some complication of a fibroid were considered. Operation showed a localized peritonitis with abscess at the brim of the pelvis and extending to the uterus and bladder on the right side. The patient made a good recovery. After the operation a sinus persisted. Some two or three months later with a probe I felt a very hard, gritty stone. This I removed with difficulty. The stone looked very much like a ureteral stone. I went over the history of this patient again with the greatest care to see if any signs of an impacted stone could be found. I never was able to determine positively whether this stone was of intestinal or of urinary origin. I always felt that it was of renal origin. It was arranged in concentric layers. It seemed to me that this stone had been impacted in the ureter and that all the symptoms and the abscess were the result of it. I never had any positive proof of its origin. The patient would never submit to an X-ray examination. There were no signs in the urine.

This case is of importance in connection with my subject because of the difficulty of telling whether the stone found in the abscess, supposed to be appendicular, was of renal or of intestinal origin. One must not jump to the conclusion when a stone of this kind is found that it has escaped from the ureter. It would have made the course of procedure of extreme doubt had I found the stone at the time of the operation. Unfortunately this patient, an ignorant and timid woman, would not, as I say, consent to an examination which would have proved the diagnosis.

In the case of Miss S., on the other hand, the proof of the renal origin was clear. This patient, twenty-five years of age, had had a severe attack of pain in the right side for which the appendix had been removed. On her way to Boston she was taken with severe pain in the abdomen and went to the Springfield Hospital, where I found her suffering with right-sided pain. She had a temperature of 101° and a pulse of 120. Following this severe attack of pain the X-ray showed a single small stone in the ureter just above the pelvic brim. I explored the ureter at the Springfield Hospital in view of the findings of the X-ray. Instead of finding a stone in the ureter I found a stricture where

the stone may have been, but there was no stone. The kidney felt abnormal. I performed a ureteroplastic operation. The patient did well after this operation but there was leakage of urine. At the time of the operation, neither the patient nor the attending physician was prepared for so severe an operation as nephrectomy. Later the patient came to the Corey Hill Hospital, where a careful study with the X-ray showed stones in the right kidney. A study of the urine showed also suppuration on that side. Cystoscopy and ureteroscopy by Dr. Chute showed no urine coming through the right ureter. I therefore removed the right kidney. The patient made a good recovery and remains well. Dr. Whitney reported "diffuse focal suppurative nephritis."

This case illustrates the error in diagnosis better than any other at my disposal. While it is possible that the appendix may have been diseased and may have required removal, in my opinion the ureteral stone was the cause of the original pain and the appendectomy had no effect whatever. In all the cases of renal and ureteral stone that I have had, the possibility of appendicitis has usually been considered especially if the urinary symptoms have been conspicuous. I have taken special pains to inquire in all cases of renal calculus whether at any time the diagnosis of appendicitis has been made. In many it has been made; in a few the appendix has been removed; and in practically all, appendicitis has been considered only to be eliminated.

In a recent case, that of a man of forty-three, the patient had always felt pain in front and back on the right side in the region of the appendix. There had been no urinary symptoms when the patient first consulted me. The attending physician and I had to consider the possibility of appendicitis before considering seriously stone, but the man was sent to Dr. Dodd, who immediately reported a large stone in the right kidney. In this case and in all cases of this kind without the X-ray one might easily be led to operate unnecessarily upon the appendix, overlooking entirely the possibility of a ureteral or a renal calculus.

Another case in which the possibility of an appendicular origin of right-sided pain was considered but in which early resort to the X-ray, suggested by blood and pus in the urine, made the

truth clear, was that of a man of thirty-eight who for three years had had right-sided abdominal pain. X-ray examination showed a stone which was passed spontaneously until it got impacted near the end of the urethra, whence it was easily removed. Later, pain in the right iliac fossa suggested either appendicitis or a second calculus. X-ray showed a stone a little beyond the pelvic brim. This also was removed.

A similar case was that of a woman of twenty-seven who in April during catamenia was seized with severe pain in the region of the appendix. In May during catamenia she again had in the region of the ovary and appendix, severe pain which lasted several days. There was no blood in the urine. In July she had severe pain with marked tenderness in the appendix region. There was, however, no rigidity or retraction of the abdomen. The pain lasted for four days and gradually subsided. It was so severe that renal stone was suspected, in spite of pain in the region of the appendix and the marked tenderness over the appendix. The urine was carefully watched and finally a little pus and blood were found in it. The radiograph taken in July showed a calculus in the lower portion of the right ureter. This was removed successfully.

One must not forget that the appendix and stone may be coincident. I have two illustrations of this.

In the first case, that of Mr. S., there was, in 1898, a distinct history of renal stone—unmistakable and confirmed by the passage of a stone from the bladder. In July, 1903, there were such unmistakable signs of chronic appendicitis that I removed the appendix. In August, 1903, the patient was taken with an acute cholecystitis while on a vacation in the woods. Dr. Cousins, of Portland, drained the gall-bladder, but a sinus persisted. I finally removed the gall-bladder with the cystic duct, which contained an impacted stone.

A case somewhat like this one was that of Mr. W., of Leominster. There were symptoms of chronic appendicitis; but something in the history suggested a urinary calculus. X-ray by Dr. Dodd showed a stone in the right ureter not far from the bladder. I first removed this stone, which proved to be a phlebolith. The appendix was enlarged and thickened, and contained two or three firm concretions. Following the ureter back to the kidney, I found several calculi in the renal pelvis. While work-

ing at the kidney I could not help noticing that the gall-bladder was full of gall-stones. The patient made a prompt recovery after removal of phlebolith, appendicular concretions, renal stones, and biliary calculi!

In these two cases had there been no urinary calculi found there was abundant evidence of a chronic appendicitis. Nothing called attention to the gall-bladder, however; and the stones at the time of the operation upon the appendix had not caused any symptoms whatever.

The cases which emphasized the error of diagnosis were those in which, after the removal of the appendix, symptoms of pain continued just the same. An appendix scar under which there is pain and tenderness has ever since these early cases suggested at once a ureteral cause. X-ray has shown that cause to be in fact present.¹

A final case illustrates appendicitis in which the pain simulates that of renal stone.

A girl of nineteen, a stenographer, for a year had recurring attacks of severe pain in the right iliac fossa, radiating in various directions. The pain lasted one or two hours and was followed by tenderness. It was described as unendurable and paroxysmal. With each attack the patient had to give up work for two or three days.

Something in the case suggested the remote possibility of a stone, and I was unwilling to operate without an X-ray examination. The urine was normal in color, acid, and had a specific gravity of 1008. It contained no albumin and no sugar. The X-ray showed no stone, and with that assurance I removed the appendix, which was a long one. From the cæcum to its tip it was a sharp V in shape. Beyond the angle the lumen was distended with fæces; on the proximal side it was empty. This case seems to me to show well the reason why some appendices cause pain suggestive of an impacted stone.

¹January 14, 1912: My most recent illustrative case is that of a woman of thirty-five, operated on fifteen years ago and also three years ago for abdominal pain. At these operations, the appendix, both tubes, and parts of both ovaries were removed. She presents herself for treatment on account of the persistence of this right-sided pain, and the X-ray—now used in her case for the first time—shows one large stone and four small ones in the right kidney.

The universal resort to the X-ray in abdominal diagnosis would be, I think, foolish. In the great majority of abdominal lesions the diagnosis is practically without reasonable chance of error, or at least of any error in which the X-ray would be of practical use. In the disease that I have been considering, however, habitual use of the method would obviate such mistakes as those that I have described. In my own practice I lean toward that side in which the X-ray is likely to prove superfluous, but in which the overlooking of a stone may mean disaster, rather than toward the side in which the chances of stone are, from the history and physical examination, so much in favor of stone that there is little possibility of error. In other words, I would insist on the X-ray more in those cases in which stone is suggested than in those in which the stone is sure to be present. That is, I would make the X-ray more and more widely used; more and more a method of precision in doubt—the greater the doubt, the greater the precision. Not that I would abandon for a moment the X-ray to confirm beyond a doubt a positive diagnosis; but I would extend its use to the much more frequent case in which the possibility of stone is suggested, if only remotely. Still further, I would use the X-ray in every abdominal case in which information of value is possible.

On the other hand, we must remember the sources of X-ray error, for even the most expert may make mistakes. I have been led into extensive and bloody search for ureteral stones that did not exist, as in the operation for phleboliths mistaken for ureteral stone; and yet this error may be avoided by the X-ray or a ureteral catheter in connection with this stone.

Such experiences suggest, of course, in the use of the X-ray the highest experts, who know not only the possible errors of conclusion, but how to overcome and neutralize these errors. It is by developing the X-ray methods in ureteral and genito-urinary surgery and in gastro-intestinal diseases that we shall find in this method the greatest assistance in avoiding errors in diagnosis.

NOTE ON THE MESOTHELIOMATA (SO-CALLED HYPERNEPHROMATA) OF THE KIDNEY.*

BY LOUIS BLANCHARD WILSON, M.D.,

OF ROCHESTER, MINNESOTA.

Director of Laboratories, St. Mary's Hospital.

ONE year ago, assisted by Dr. B. C. Willis, I presented before the Association of American Pathologists and Bacteriologists¹ the results of my studies on 48 cases of so-called "hypernephromata" of the kidney. The literature was reviewed from Grawitz's hypothesis of the adrenal origin of these tumors to January 1, 1910. My observations on the tumors and a re-survey of the relational development of the kidney and suprarenal supported Stoerck's² objections to the Grawitzian hypothesis. It seemed to me, however, that there were serious objections to Stoerck's suggestion that these neoplasms arise from convoluted tubules in the contracting kidney. On the contrary, the evidence presented seemed to support and extend Adami's³ view that these tumors are mesotheliomata of renal origin. Indeed, it appears that all the phenomena observed to date in relation to the so-called "hypernephromata" are best interpreted by the hypothesis that they are the result of proliferation of islets of nephrogenic tissue (mesoblast) which have never become connected with the renal tubules (derived from the Wölffian duct).

Since my report Zehbe⁴ has published his observations on a few specimens, which he holds confirm Stoerck's objections to the Grawitzian hypothesis and also Stoerck's suggestion that they do arise in compensatory hypertrophy of renal tubules.

*Read before the Assn. of Am. Phys., May 10, 1911.

¹ Wilson and Willis: *Jr. Med. Res.*, xxiv, 1910.

² Stoerck: *Beit. z. Anat. u. Allg. Path.*, 1908, xlii, pp. 393-437.

³ Adami: *Prin. of Pathology*, vol. i, pp. 745-747.

⁴ Zehbe: *Virchow's Arch. f. Path. Anat.*, Ed. 201.

Sisson⁵ also has reported his studies on five adenomata of the suprarenal and five so-called "hypernephromata" of the kidney. He agrees with Stoerck and myself that the renal tumors have no relationship to the suprarenal, but he finds no evidence of their having arisen from contracted adult renal tissue. He re-states in part my view that they take their origin from isolated nephrogenic tissue, but says that they may possibly also arise from the ureteral bud.⁶

Since the previous report I have studied five more cases of nephrogenic mesotheliomata. All of these confirm the original observations, that each tumor contains areas which are histologically recognizable reproductions of the various stages of the development of the renal cortex from the nephrogenic tissue, while at the same time furnishing pictures which are not found in the suprarenal.

The relationship of the renal tumors of embryonic origin (teratomata, mesotheliomata) as we now understand them may be expressed as follows:

1. *Teratomata or the mixed tumors of Wilms.* These are the most common form of malignant renal tumors of early childhood. Histologically they contain, besides epithelial cells and round- and spindle-sarcoma cells, also hyaline cartilage, striped or unstriped muscle fibres and occasionally ganglion cells. Their origin is probably from very early inclusions within the nephrogenic tissue of portions of the myotome which normally should form skeletal structures.

2. *Nephromatous mesotheliomata* (the so-called malignant "hypernephromata" or "Grawitzian tumors"). These form the larger share of malignant renal tumors of the adult and are frequently wrongly diagnosed sarcomata. Their tissue elements and cell mutations are confined to those passed through normally by the nephrogenic tissue in the development of the renal cortex. They probably arise from masses of nephrogenic tissue which have remained isolated from the surrounding adult renal cortex.

⁵ Sisson: Zeigler's Beit., Bd. 49, 1910.

⁶ The obvious objection to this latter supposition is that we do not find in these tumors epithelium of the adult renal pelvic type.

3. *Wölffian "rests" or "tumors."* These are fairly numerous small masses of yellowish-red tissue included within the renal cortex and frequently mistaken for "adrenal rests." Histologically they are distinguishable as of Wölffian origin. They are seldom encapsulated and are always benign. They result from the inclusion within the early formed renal cortex of tubules of the atrophying Wölffian body.

4. *Adrenal "rests" or "tumors."* These are freely described by many observers, but are certainly much rarer than is commonly supposed. They are small, usually whitish masses embedded within the renal cortex and usually encapsulated. Careful microscopic examination of such masses will show that most of them belong in group 3, i.e., are of Wölffian origin.

Such a classification may be of interest to the clinician as explaining certain diagnostic phenomena. Thus teratomata and nephrogenic mesotheliomata are rarely preceded by symptoms of other renal lesions, while primary carcinomata of the kidney very often take their rise from the site of renal calculi. Teratomata, derived from the earliest isolated embryonic tissue, develop in infancy or early childhood. Though of exceedingly rapid growth they are usually so well isolated that early they produce no symptoms except abdominal enlargement, and rarely form metastases.

Nephrogenic mesotheliomata may be considered as developed from embryonic tissue which, while isolated, is yet surrounded by structures developed from similar tissue. This may explain why these tumors usually fail to develop until late adult life. While their growth is often slow, the suddenness with which they sometimes appear after an injury may perhaps be due to the "rest" consisting of a relatively large amount of isolated nephrogenic tissue. That they originate from embryonic rather than adult epithelium may account for the fact that their metastases are by way of the blood stream and not by way of the lymphatics.

Though these suggestions must for the present remain somewhat speculative, they may not be unworthy of consideration.

THE SURGICAL TREATMENT OF DIVERTICULA OF THE URINARY BLADDER.*

WITH THE REPORT OF A CASE AND A NEW DEVICE FOR FACILITATING THE
OPERATION.

BY WM. LERCHE, M.D.,

OF ST. PAUL, MINN.

THE presence of a diverticulum of the bladder, when so situated that stagnation of its content is favored, is a constant source of danger to the patient if it becomes inflamed.

Of the various methods of treatment of this condition, the radical removal of the diverticulum by excision has given the best result. The report of fourteen cases thus operated upon can be found in literature, namely, those of Alexander (1884), Czerny (1897), Riedel (1903), Pagenstecher, Young (3 cases), Wulff, Von Eiselsberg (1904), Porter (1907), V. Eberts (1909), Kroiss, Zaaier, Brongersma (1911). To this number I wish to add the report of a case that has come under my own observation.

Male, aged thirty-eight. Measles, whooping-cough, and chicken-pox in childhood. At the age of twenty-eight the patient experienced two attacks of severe pain in the left abdomen and one attack in the corresponding part of the right side in the course of a year. These attacks were diagnosed as renal colic. He passed no blood in the urine, nor did he pass any calculi. At the age of thirty-one he had an attack of urethritis, which healed in three weeks. Nine months later he had an attack of gonorrhœa, which lasted for fifteen months, but finally healed completely. Urethral sounds were passed for a long time first by the attending physician, later by the patient. Four years previous to consultation the patient noticed thick whitish material in the urine at intervals of a few weeks. Occasionally he had spasm of the sphincter urinæ and could not quite finish the urination. He

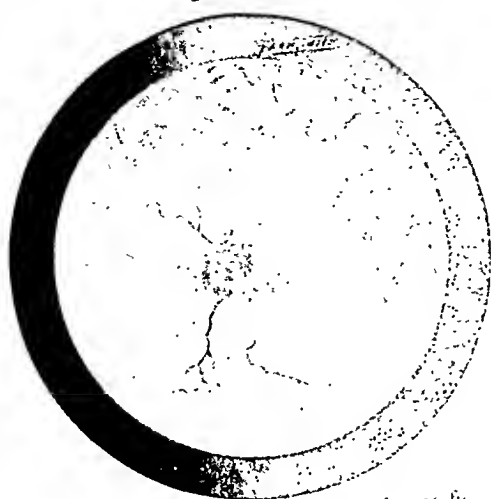
* Read in abstract at the Minnesota State Medical Association, Oct. 6, 1911.

suffered no pain nor any other inconvenience. Now and then he noticed that on urinating in the morning he could pass urine again shortly afterward. During the last two years the whitish material in the urine has appeared at shorter intervals and has been more abundant, and the urethra has been somewhat sensitive. The condition grew worse since January, 1910, with frequent urination, and he was treated with irrigations of the bladder and instillations.

When the patient came under my care a general examination except that of the urinary tract was negative. The prostate was slightly enlarged, and an enlargement was felt in the region of the left seminal vesicle. Repeated examinations showed a residual urine of 200 c.c., which contained a great deal of pus and slime. There was no tenderness nor enlargement in the region of the kidneys or over the bladder. The urethra accepted a 29 F. sound. The bladder was irrigated daily and solution of nitrate of silver instilled. The urine cleared up considerably, but could never be kept entirely free from pus and shreds.

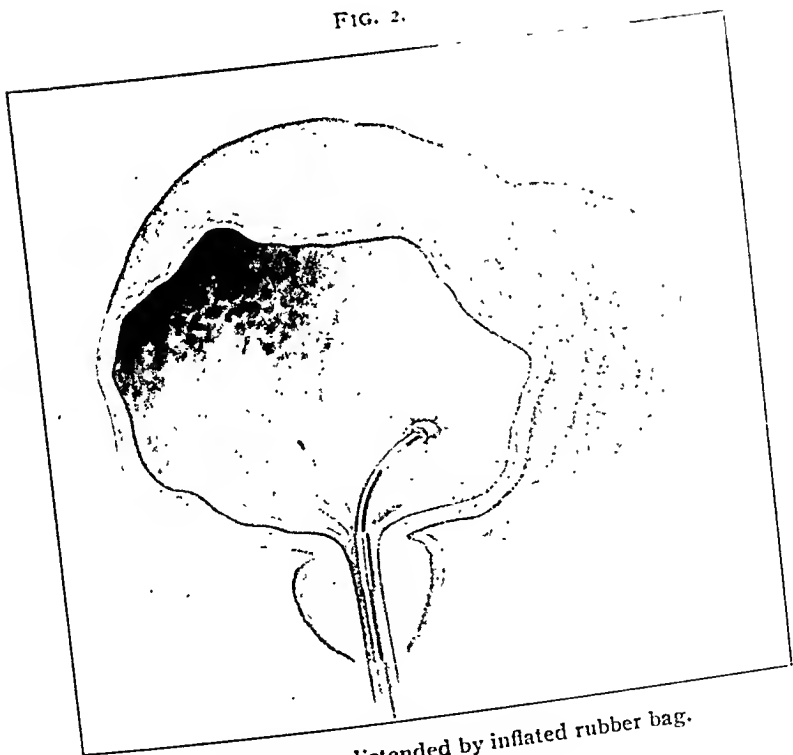
Cystoscopy.—After thorough irrigation of the bladder, 350 c.c. of a boric acid solution was left in the viscus and the cystoscope introduced. The bladder was found to be trabeculated, and there was evidence of cystitis. The left ureter could not be seen, but in that region was discovered a black hole. This opening (Fig. 1) was oval in outline with the lower border somewhat straighter than the upper. It was about 1 cm. in its longest diameter and its margin was thick, as shown in cut, with blood-vessels and radiating folds of mucous membrane curving over it. Whitish, thin shreds could be seen floating in and out of the opening. It was impossible to get the cystoscope into the opening. The left side of the posterior wall of the bladder was bulging forward (Fig. 2), and the right ureteral orifice was on a plane more posteriorly. A diagnosis of diverticulum was made and to verify this a radiograph was taken after introducing 400 c.c. of a 5 per cent. collargol solution into the bladder, a method first used by Volcker in radiographing the kidney pelvis. With the patient flat on his back the plate did not show anything abnormal, but with the patient turned about 35° the diverticulum showed up very well (Fig. 3). The radical removal of the sac was decided upon. In planning the operation the thought occurred to me that if the diverticulum could be distended inde-

FIG. 1.



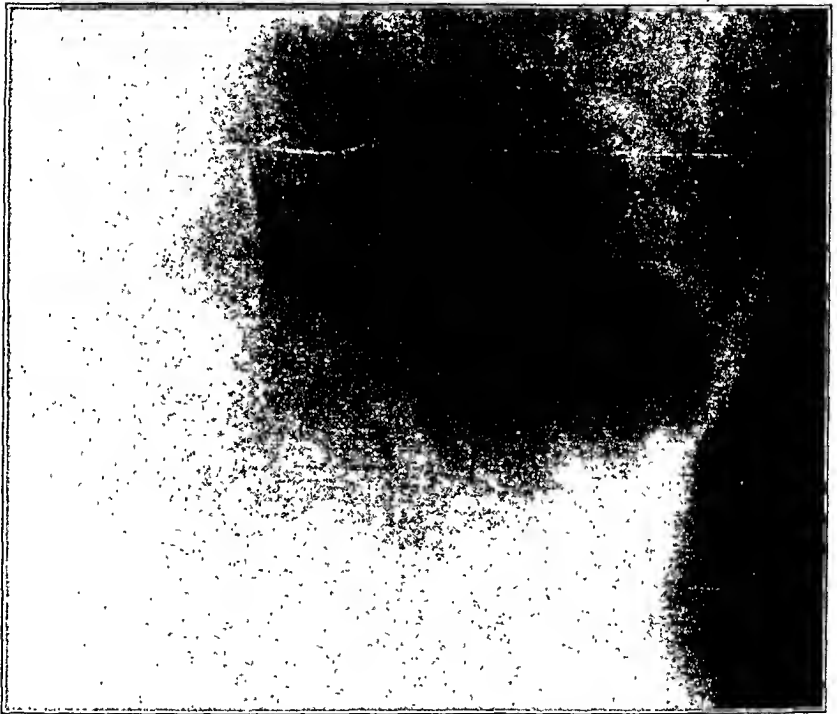
Cystoscopic view of diverticular orifice.

FIG. 2.



Diverticulum distended by inflated rubber bag.

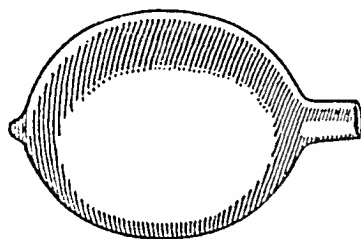
FIG. 3.



Radiograph of diverticulum and bladder taken from left side.

pendently of the bladder, with the latter in a somewhat collapsed condition, it would materially lessen the difficulty of dissection by converting the diverticulum into a tense cyst and raising it higher up in the pelvis. To that end I had little rubber bags made (Fig. 4), which could be fastened securely with a silk thread to the ureteral catheter and wrapped around the latter, a tiny rubber band (*A*, Fig. 5) being slipped over to keep the bag, *B*, in place. When the bag is distended this rubber band is forced off and later

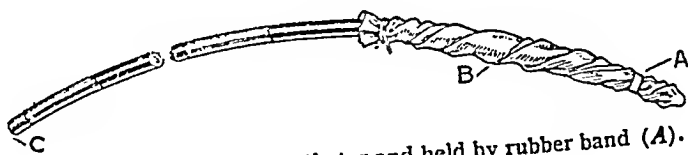
FIG. 4.



Rubber bag (actual size).

passed off by the urethra. The funnel-shaped part of the proximal end of the catheter is cut off (*C*, Fig. 5), in order to enable this end to be introduced backward through the distal end of the catheter carrying tube on the cystoscope. A Brown-Buerger cystoscope is used for the purpose. Fig. 6, *A*, shows the catheter with rubber bag being introduced into the mouth of the diverticulum, *B*. When the rubber bag is in the diverticulum, boric

FIG. 5.

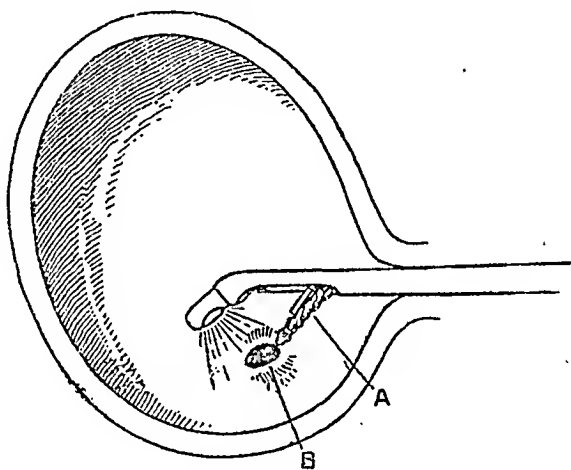
Rubber bag (*B*) tied to catheter and held by rubber band (*A*).

acid solution or normal saline is injected through the catheter into the sac until resistance is noticed. The corresponding amount of fluid is drawn off from the bladder. The bulging rubber bag can also be observed in the mouth of the diverticulum through the cystoscope. The number of cubic centimetres used will give the exact size of the diverticulum. When the latter is fully distended the proximal opening of the catheter is plugged by a thick, straight needle. The diverticulum in my case measured exactly 200 c.c.

Operation.—With 350 c.c. of a boric acid solution in the

bladder, the rubber bag on the ureteral catheter was introduced into the diverticulum through the cystoscope; 200 c.c. of boric acid solution was injected into the rubber bag in the diverticulum, while the corresponding amount was let out of the bladder, leaving about 150 c.c. or less of the solution in the latter. The distended diverticulum could be felt per rectum like a tense cyst. Ether anæsthesia. Through an incision 10 cm. long through the left rectus muscle, with the patient in the Trendelenburg position, the pelvis was entered extraperitoneally. The peritoneum was stripped off from the left side of the bladder and pelvic wall, and the tense wall of the diverticulum reached. The benefit of the

FIG. 6.

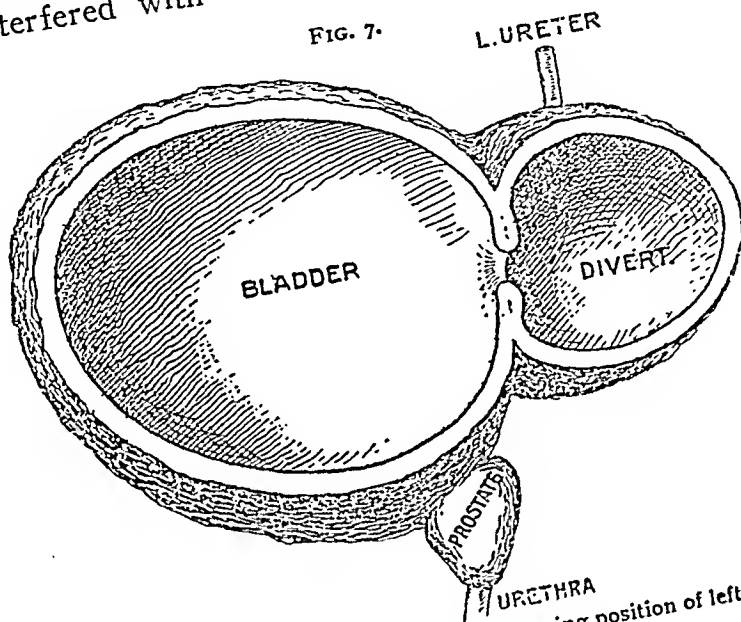


Catheter with rubber bag in cystoscope ready to be introduced into diverticulum.

rubber bag scheme was immediately appreciated. An attempt was made to dissect the diverticulum off from the peritoneum, but this could only be done half way around on account of the firm adhesions. The outer layer of the wall of the diverticulum was therefore cut through, and it could then be shelled out. The left ureter was found on the mesial side of the diverticulum being pushed to the right, and the left seminal vesicle was behind and underneath it. The diverticulum had somewhat undermined the trigonum, and it extended backward into the hollow of the sacrum and was adherent to the rectum. The rubber bag was now emptied, and on cutting through the neck of the diverticulum from the left side the bag with the catheter could be pulled out through the abdominal wound. The orifice of the left ureter was seen on the mesial wall of the diverticulum about 1 cm. from the

opening into the bladder (Fig. 7). The diverticulum was removed and the opening in the bladder sewed up with two layers of continuous formalized catgut sutures, the left ureter being implanted into the bladder through the same opening. Split tube drainage with gauze wick was left in the large extraperitoneal cavity, and the abdomen closed except for drainage opening. The neck of the bladder was dilated to 43 F. with a Kollman dilator and a retention catheter was left in the bladder. The extraperitoneal drain was removed on the fourth day. Frequent spasms interfered with the bladder drainage, and a posterior

FIG. 7.



Lateral view of bladder and diverticulum, showing position of left ureter.

urethrotomy was therefore made and a large tube put into the bladder. The neck of the bladder was found hard and fibrous and did not admit the tip of the forefinger. The patient made an uneventful recovery and left the hospital on the thirty-fourth day. Three weeks later I removed part of the fibrous neck with Young's¹ ingenious median prostatic bar excisor *per urethram* under local anæsthesia.

The patient has been well since and has gained in weight. The urine was cloudy for some time after the operation.

The inner surface of the diverticulum was smooth and of a dull greyish-red color; there were no trabecula in the sac. The epithelium was absent in places; muscular fibres were present in the wall.

RÉSUMÉ OF OPERATIVE METHODS IN THE FOURTEEN CASES RADICALLY
OPERATED UPON.

Vaginal Route:—Alexander's² case: A diverticulum of the bladder protruded from the vulva. A stone was removed from the sac and the latter was ligatured at its neck and cut off. The woman recovered with a small fistulous tract.

Sacral Route:—Pagenstecher's³ case: Male, aged 33. Suprapubic cystotomy disclosed a diverticulum with its opening in the region of the left ureteral orifice. Drainage of diverticulum. Second operation: temporary resection of sacrum, removal of diverticulum, and transplantation of left ureter, which ended in the diverticulum, into the bladder. Recovery. Sacral scar painful. Sacral urinary fistula present when last seen.

Suprapubic Intraperitoneal Route:—Von Eiselsberg's case, reported by Wagner:⁴ Male, aged 48. No prostatic enlargement. Cystoscopy: trabecular bladder, diverticulum near summit on right side. Intraperitoneal excision of diverticulum, closure of bladder wound with catgut. Retention catheter. Recovery.

Riedel's⁵ case: Male, aged 61. Moderate prostatic hypertrophy. Partial prostatectomy. Continuation of symptoms. Later suprapubic cystotomy revealed a large diverticulum with large opening above right ureteral orifice. Bladder temporarily closed, then incision through right rectus muscle. Serosa over diverticulum incised and the latter dissected free, invaginated into the bladder, and removed. Diverticular orifice closed intra- and extravesically with catgut. Abdominal drainage of cavity, perineal drainage of bladder. Death.

Zaaijer's⁶ case: Male, aged 58. Moderate prostatic enlargement. Suprapubic cystotomy. An opening found to a diverticulum behind the interureteric bar. Trabecular bladder. Septum divided and margins sutured. Functional result poor. Second operation: Laparotomy. Suprapubic cystotomy. Peritoneum over diverticulum incised, the sac dissected free, pulled into the bladder, and cut off. Diverticular orifice closed intravesically. Perineal drain behind bladder. Abdominal incision closed. Cystotomy wound left open—drainage. Recovery.

Porter's¹⁰ case: Male, aged 34. Prostate moderately enlarged. Cystoscopy: Three diverticula. First operation, suprapubic drainage. Second operation, suprapubic cystotomy reopened and the orifices of the diverticula stretched. Drainage. Third operation, incision parallel with Poupart's ligament. Peritoneal cavity opened. Cystotomy wound reopened. The largest diverticulum was excised. Suprapubic drainage and retention catheter.

Later: suprapubic fistula keeps open if urethral catheter is not in place.

Suprapubic Extraperitoneal Route:—Czerny's⁷ case: Male, aged 30. Traumatic stricture of membranous urethra. Suprapubic cystotomy revealed a diverticulum with opening in the region of left ureteral orifice. Suprapubic drainage of diverticulum. Second operation: Diverticulum

removed extraperitoneally through a transverse incision of the left rectus. The left ureter terminating in the diverticulum was transplanted into the bladder. Opening closed with two rows of catgut. Suprapubic drainage, also urethral retention catheter, drainage of the extraperitoneal cavity through abdomen. Four months later left nephrectomy. Recovery.

Young's* case: Male, aged 30. Urethral stricture. Cystoscopy. Two diverticula, one very large. Suprapubic extraperitoneal excision of both; right ureter in diverticulum was sewed into the bladder with a flap cut of mucosa. Drainage of bladder through a perineal urethrotomy. Drain of extraperitoneal cavity by tube behind prostate through perineum. Suprapubic fistula healed later after a Bottini operation on middle prostatic lobe. Cure.

Young's case: Male, aged 34. Cystoscopy. Small diverticulum in urachus caused by a fall. Suprapubic extraperitoneal excision of sac. Cure.

Young's case: Male, aged 63. Cystoscopy. Large diverticulum due to prostatic hypertrophy. Suprapubic extraperitoneal excision of diverticulum, perineal prostatectomy. Cure.

Wulff's* case: Male, aged 34. Cystoscopy, diverticulum on right side. Incision parallel with Poupart's ligament; diverticulum opened extraperitoneally, cavity tamponed. Later diverticulum excised and communication with bladder closed. Retention catheter in bladder. Bladder sutures failed. Later edges of opening into bladder had to be freshened and sutured again. Patient when discharged had 150-200 c.c. residual urine.

V. Eberts'¹¹ case: Male, aged 32. Right-sided nephrectomy for pyelonephrosis. Urine continued cloudy—hence suprapubic cystotomy, which revealed a diverticular opening 2.5 cm. to the outer side of the right ureteral orifice; drainage of diverticulum. In a third operation the diverticulum was removed extraperitoneally through a suprapubic incision, aided by a finger in the diverticulum through the reopened bladder wound; opening closed with a purse-string suture. Suprapubic drainage of bladder. Drainage of extraperitoneal cavity through perineum. Cure.

Kroiss'¹² case: Male, aged 28. Cystoscopy; X-ray. Orifice of diverticulum 2.5 cm. behind and to the left of the left ureteral orifice. Large suprapubic cross incision to left of median line. Diverticulum removed extraperitoneally with the aid of the finger in the sac through a suprapubic cystotomy opening. The opening of communication closed with interrupted sutures. Suprapubic drainage of bladder. Extraperitoneal cavity tamponed and wound left entirely open. Recovery.

Brongersma's¹³ case: Male, aged 61. Bladder trouble since age of 15. Prostatic hypertrophy. Cystoscopy. Diverticular opening to the left of left ureteral orifice. X-ray. Suprapubic extraperitoneal excision of diverticulum. Closure of diverticular orifice with catgut. Recovery.

The case of Péan,¹⁴ which by a number of writers has been grouped with the diverticula, seems to be a case of supernumerary bladder—an embryonal malformation—and is therefore perhaps better grouped with

the cases of Wolfier and Colzi (cit. by Schwartz¹⁵), and does not belong to the diverticula described in this paper. For the reason, however, that several writers have included the case, it is appended here.

Péan's case: Female, aged 15. Incontinence of urine since birth. A small sac was felt through the anterior vaginal wall, which communicated with the exterior through an 8 cm. long canal terminating 3 mm. below the normal urinary meatus. Péan dissected out the mucous membrane of the sac and canal and closed the defect. The sac communicated with the bladder. Cure.

Wolfier's case: Female, aged 12. Incontinence of urine since birth. Below the normal meatus was found a minute opening from whence came urine. No communication could be demonstrated between the bladder and sac. Both the urethral canals were forcibly dilated, and an anastomosis made between the bladder and sac with a specially constructed pressure forceps. The patient was "almost" relieved of her incontinence.

Colzi's case: In a young girl with incontinence of urine. An extra opening was found below and to the left of the normal meatus, from which dribbled urine. At operation it was found that this opening communicated with a sac into which ended the left ureter. The sac was extirpated and the ureter implanted into the bladder. Recovery.

Of other methods of treatment can be mentioned:

(a) Simple incision through the vaginal wall with drainage of the diverticulum.

Chaput's¹⁶ case: Female, aged 50. Tumor to right of cervix uteri thought to be fibroma. Incision through vagina revealed a vesical diverticulum containing large quantity of urine and mucopus. Communication with bladder could not be found. Drainage of bladder and diverticulum. Recovery.

(b) Establishment of a fistula by sewing wall of diverticulum to the skin of the abdominal wall.

Ljunggren's¹⁷ case: Male, aged 12 years. Ljunggren first made a fistula between diverticulum and abdominal wall. One year later he made an anastomosis between the bladder and the diverticulum. Cure.

(c) Perineal drainage of the bladder.

Burckhardt's case: (Cit. by Pagenstecher. The case was reported by Burckhardt, but not treated by him.) Male, aged 43. Cystoscopy. Diverticulum above right ureteral orifice. Perineal urethrotomy through which the bladder was drained. Death.

(d) Forcible stretching of the orifice of the diverticulum.

Guibal's¹⁸ case: Male, aged 68. Gonorrhœal stricture and prostatic hypertrophy. Suprapubic cystotomy. The bladder of the size of a hen's egg; the diverticulum held a quart and a half. The orifice of the diverticulum was forcibly dilated with the finger. Suprapubic drainage. Death.

Mumford's case: Suprapubic cystotomy with drainage of the bladder was first done, without relief. Later suprapubic cystotomy with stretching of the diverticular orifices with negative result. Finally the case was radically operated upon. (Reported by Porter, *loc. cit.*)

Langer's¹⁰ case: Male, aged 38. No stricture, stone, nor prostatic hypertrophy. Suprapubic cystotomy. Dilatation of the orifice of the diverticulum. Death.

(e) Curettement of diverticulum and closure of its margins with sutures.

Pousson's²⁰ case: Male, aged 78. Prostatic hypertrophy. Suprapubic cystotomy, three calculi. Middle prostatic lobe removed. A small diverticulum containing a calculus was curetted and edges of orifice freshened and united by sutures. Bladder drained. Cure.

(f) Invagination of diverticulum into bladder, freshening of margins of orifice, and closure intraperitoneally.

V. Eiselsberg's case. (Reported by Wagner, *loc. cit.*) Male, aged 58. Three diverticula demonstrated by cystoscopy. Laparotomy. One small diverticulum near the summit was invaginated into the bladder and the margins closed by sutures. The larger diverticulum could not be found. Death a few months later.

(g) New anastomosis between bladder and diverticulum.

Ljunggren's case, *loc. cit.* Cure.

(h) Enlargement of diverticular orifice by incision of the septum or crushing with forceps.

Young's case, *loc. cit.* Male, aged 66. Cystoscopy revealed two diverticula. Suprapubic cystotomy; incision of septa; suture of cut edges. Voluntary urination restored; patient well, but has 300 c.c. residual urine.

Zaaijer's case, *loc. cit.* Male, aged 58. Suprapubic cystotomy; division of septum; suture of cut edges; functional result poor. Later radical excision of diverticulum.

Serralach's²¹ case: Suprapubic cystotomy; several incisions in the margin of the diverticular orifice. Recovery. Functional result negative.

Lennander's case reported by Zachrisson:²² Male, aged 21 months. Retention of urine and cystitis came on after operation for phimosi. Suprapubic cystotomy disclosed a diverticulum. A fistula was established by sewing the bladder to the skin of the abdomen. In a second operation a strong silk thread was passed through the septum and the diverticular orifice and tied tight in order to cut through. In a third operation a strong curved forceps was applied to the septum and an opening was made by gradually tightening the forceps. Patient left hospital with 200 c.c. residual urine and cystitis. When seen 18 months after operation cystitis was still present. At postmortem, according to Lennander²³ the left kidney was found to have double pelvis with two ureters which ended in the diverticulum. The right ureter and the urethra were found in the bladder proper. Abscess in kidney.

(i) Suprapubic drainage.

Englisch's²⁴ case: Male, aged 60. Prostate somewhat enlarged, particularly the middle lobe. Diverticulitis. Suprapubic cystotomy; drainage of diverticulum for seven months; pain disappeared but diverticulum remained unchanged.

Strauss's²⁵ case: Male, aged 29. Frequent urination for years, worse

since age of 27. Suprapubic incision disclosed two thin-walled sacs communicating with the anterior wall of the bladder. Incision of sacs; drainage. Cure. Strauss describes this as a case of triple bladder—a congenital malformation. Englisch (*l.c.*) comments upon it as a case of diverticula of the bladder.

Fischer's²⁶ case: Male, aged 75. Suprapubic cystotomy; drainage of diverticulum. Improved. Death one year later from uræmia, pyelonephritis.

Wright's²⁷ case: Male, aged 38. Suprapubic cystotomy revealed a hypertrophied bladder, with which communicated a diverticulum. The latter was four times the size of the bladder and its orifice of communication was near the right ureter. Drainage. Death.

(j) Perineal drainage of diverticulum behind the prostate.

Cholzoff's²⁸ case. Male, aged 26. Cystoscopy; diverticulum on left side. Suprapubic cystotomy and perineal incision; left ureter which terminated in diverticulum was transplanted into an opening made in the bladder; diverticulum drained through perineum; bladder stitched to skin suprapubically. In a second operation an attempt was made to remove the diverticulum, but without success. Through suprapubic cystotomy the mucous membrane at the neck of the diverticulum was then cut through and the edges closed with catgut; suprapubic drainage of bladder and perineal drainage of diverticulum. Sutures gave way and diverticular orifice reopened. In a third operation the suprapubic fistula was closed and an extraperitoneal fistula curetted. All urine passes through perineal fistula.

Etiology and Pathology.—By diverticula are meant those limited protrusions or bulgings of the bladder wall which only affect a small portion of the periphery of the latter.

Of the older writers Heister used the designation diverticulum; Morgagni, Saccus; Walther, hernia vesica; Cruveilhier, hernia tunicaire de la vessie. Of other synonyms can be mentioned vesica bipartiti; vesicæ accessorïæ; cystocele interna (Chopart); vesica supernumeraria, etc.

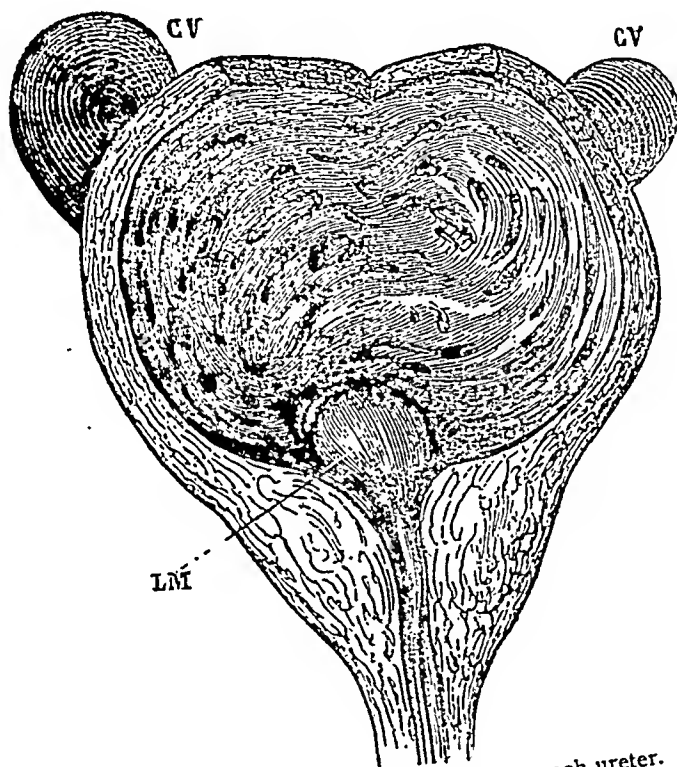
Englisch²⁹ divided diverticula of the bladder into those: (a) whose walls consist of muscular fibres and mucosa (Taschen); (b) whose walls consist of mucosa only (Zellen).

The former variety is also called congenital, the latter acquired diverticulum. Sugimura³⁰ following Aschoff unfortunately uses the terms true and false diverticula in the sense corresponding respectively to "taschen" and "zellen." Orth⁴² understands by a false diverticulum a perivesical cavity that communicates with the bladder but that has none of the coats

of the latter; it is usually formed by a perivesical abscess that has ruptured into the bladder, and whose walls consist only of dense connective tissue. Such cases have been described by Targett and one reported by Billroth,³¹ Voillemier and Le Dentu (cit. by Englisch) used the names *cellules et poches*.

Fano³² calls both varieties *cellules vésicales*, and he mentions the following synonyms, *kystes*, *chatons*, *appendices*,

FIG. 8.



Diverticula symmetrically placed with regard to each ureter. (After Fano.)

poches, and *cavités accidentelles*. In his description Fano calls the small depressions *little cellules*, and the two large ones *large cellules* (Fig. 8). Civiale (cit. by Fano) distinguishes between *cellules contractiles* and *cellules non-contractiles* according to the presence or absence of muscular tissue in the wall of the diverticulum.

Targett³³ and Harrison³⁴ describe *sacculi* and refer to *pouches* as mere depressions. Hodgson³⁵ speaks of *pouches* and refers to the *sacculi* as merely the early start of the *pouch*.

Cases similar to the one reported by me in this paper have been described in recent German and French literature as congenital diverticula of the bladder.

The usage of the terms seems somewhat confusing and therefore in the following I apply the term *diverticulum* to both varieties, simply distinguishing the one with a coat of muscularis and mucosa as a "muscular diverticulum," and the other whose wall has mucosa only as a "mucous diverticulum."

Taschen (the muscular diverticula), according to Englisch, have certain seats of predilection, namely: (1) on the lateral walls of the bladder near the ureteral orifices; (2) toward the base of the bladder above the interureteric bar; (3) at the summit corresponding to the region where the urachus enters the viscus. They occur mostly singly, and most frequently near the left ureteric orifice, but two or more may be present in the same bladder. Englisch ascribes the reason for this predilection to anatomic causes. The longitudinal muscle bundles on both sides of the urethral orifice leave a space free, which is only covered by the circular and oblique muscle bundles—a *locus minoris resistentia*—and in case of intra-uterine obstruction to the outflow of urine, a diverticulum may develop at this weak spot. Englisch^{36 37} has repeatedly observed such obstructions in the new-born, often due to agglutination of the epithelial lining of the urethra. If the obstruction is merely of short duration the wall may just become pushed out a little at this spot, sufficient, however, to lessen its power of resistance. The further development may occur later in life, when again obstruction to free micturition arises, causing hypertrophy of the bladder wall and the formation of the diverticulum. Such development of the diverticulum may also take place without hypertrophy of the bladder wall. Where the diverticulum is congenital, the bladder is rarely found trabeculated. When a diverticulum is present in a hypertrophied bladder, trabecula may also be present in the diverticulum. Another seat of predilection is the top of the bladder. Two different types may develop here. The one consists of a dilatation of the vesical end of the urachus, which has remained patent. It has thin walls of circular and longitudinal muscle-fibres, and a mucous lining bearing more resemblance to a serous membrane. Its form is apt

to be cylindrical. The other type is a dilatation of the upper part of the bladder close behind the urachus; the formation of this Englisch explains as being due to the longitudinal muscle bundles immediately surrounding the region of the implantation of the urachus having thinner and wider meshes, while the circular fibres seem more strongly developed. The least frequent seat of the muscular diverticulum is above the interureteric bar, where they are found mostly in the presence of hypertrophy of the bladder in consequence of an enlarged prostate. The width of the diverticular orifice varies from 1 to 10 cm.; the thickness of the margin of the opening from 1 to 8 mm. The orifice may be circular or oval. This variety of diverticulum has been observed as large as six times that of the normal bladder.

Zellen (the mucous diverticula), according to Englisch, are of relatively common occurrence, as they come on in consequence of those disturbances to the outflow of urine, with which is connected hypertrophy of the muscular bladder wall—most frequently hypertrophy of the prostate. The depressions between the hypertrophied muscle bundles or trabecula correspond to the interstitial connective tissue. Early in its development the mucous diverticulum may have in its wall, beside the mucous membrane, the outer muscular layer of the bladder, but with the growth of the sac the muscle fibres are pushed aside and the wall consists of mucosa only, with muscle fibres around its neck and a little beyond. The width of the orifice of the diverticulum varies from 2 mm. to 2 cm. or more. In size these diverticula range from that of a pea to the size of the bladder or larger. It may occur singly or in large number; Englisch has seen a bladder with 40 diverticula, of which 28 contained calculi. This form does not show the regularity in distribution of the former variety. It is, however, mostly formed on the posterior wall from above the interureteric bar toward the summit, and on the side walls above the ureteral orifice toward the summit. It is rarely found on the anterior wall.

Targett³³ describes sacculi as protrusions of mucous membrane through the muscular coat of the organ in consequence of some mechanical obstruction to the outflow of urine. They occur mostly singly, but two or three may be present. If two are present they are often symmetrically placed with regard to each ureter (Fig. 8); such a case is also reported by Sugimura.³⁸

They have narrow mouths and may occur at any part of the bladder except the trigone, but are most frequently met with toward the base. The explanation may be that the felting of the muscular fibres is here most interrupted by the entrance of the large vesical arteries. Targett demonstrated a specimen in which the right ureter terminates in the sacculus, owing to its formation at the spot where the ureter perforates the vesical wall, and the gradual shifting of its orifice.

Pouches, according to Targett, consist of an irregularly shaped protrusion of all the vesical coats more or less thinned by distention. They have wide mouths, and not infrequently result from the pressure of a vesical calculus.

Harrison³⁴ gives as causes for the formation of sacculi (1) intra-uterine, (2) obstacles to micturition, (3) traumatic. He describes pouches as mere depressions in the most dependent portion of the bladder in which the whole thickness of the wall is involved.

Buckston Browne³⁹ suggests the following division: (1) the ordinary sacculi, (2) the post-trigonal pouch, and (3) the post-prostatic or trigonal pouch. Both the latter varieties usually hold calculi. Browne reports cases of post-prostatic pouches of considerable size containing calculi.

Hodgson³⁵ explained the formation of pouches as follows: In cases of long-continued obstruction to free evacuation of the urine, the bladder becomes gradually dilated as the amount of residual urine increases in quantity, and the muscular coat is hypertrophied in proportion as the impediment to free micturition progresses. As the musculature becomes hypertrophied, the fibres gather into bundles between which are seen depressions of the mucous lining when the viscus is contracted. If the obstruction continues to advance, the residual urine to accumulate in larger quantities than is consistent with further general dilatation of the viscus, and the muscular coat begins to act with increased power, the efforts to micturate unavailing to expel the whole of the fluid forward cause the expulsive force to act on the bladder. The residual urine now dilates the little depressions by degrees into pouches, which become larger and larger as the disease progresses, until they may attain even the size of a man's fist. This process extends over a long course of time. Internally, each pouch is lined with the displaced mucous membrane; exter-

nally, its wall is formed by submucous fibrous tissue, thin and dilatable when the sac is small, hard, gristly, and resistant for the most part when large. In addition there is a peritoneal covering where this membrane is reflected. Generally speaking the size of the pouches is in inverse ratio to their number, being either small and numerous or large and few.

Young^s found that in all of the cases that had come under his observation, either operated upon by him or seen post mortem, the walls of the diverticula contained muscle in varying degree, even in those due to obstruction late in life.

The largest diverticulum on record is that reported by Warren Greene.⁴⁰ Male, aged 84. Prostatic hypertrophy. Post-mortem revealed a hypertrophied bladder communicating through an opening on its left side with a diverticulum which held about one gallon of limpid urine. There was no muscular tissue in the wall of the diverticulum.

The following interesting case of Holmes⁴¹ is included here because it shows that a mucous diverticulum may also form in utero. In a newborn, otherwise well-built boy was found a protruding belly. Death in eight days. Postmortem showed great defect in the musculature of the belly. The kidney substance, particularly on the left, had greatly disappeared, and the ureters were distended and tortuous. The bladder consisted of two sacs, of which one had the ureteral orifices and the urethra, which were patent. The wall of the bladder proper was greatly hypertrophied—three times thicker than normal. The second sac, occupying the right side of the pelvis directly under the skin, was round and of the size of the bladder, with which it communicated through an opening half an inch wide. Its wall was thin and had not a trace of muscle fibres. Cause of death said to be obstruction to urination.

The conclusions, in regard to the etiology, to be drawn from the foregoing are that both the muscular and the mucous diverticula may form before birth and also that they may both develop later in life; but in either instance they are formed in consequence of some obstacle to the outflow of urine.

The presence of muscle in a large diverticulum does not seem to be a proof of the congenital origin of the latter, as maintained by Englisch and others, because muscle tissue has been found present in large acquired diverticula. The termination of one of the ureters in the diverticulum is by some

considered a proof of the anomaly being congenital. The specimen demonstrated by Targett, however, shows the ureter terminating in a diverticulum due to obstruction to micturition caused by an enlarged prostate.

In my own case it is possible that the fibrous changes in the neck of the bladder have been the slow cause of the trabeculation of the viscus and of the formation of the diverticulum. The trabeculation of the bladder proper, the absence of trabecula in the diverticulum, and the shape of the orifice of communication would rather be in favor of the view that the diverticulum has originated late in life. The almost straight lower margin of the diverticular orifice suggests that that shape has been determined by a hypertrophied bundle of muscle, and that the formation of the diverticulum therefore has taken place secondarily to the trabeculation caused by the obstacle to urination. If that is the case the vesical end of the ureter has simply become gradually shifted into the diverticulum in the course of its development by pressure. The anomaly, however, may have been congenital in the sense regarded by Englisch.

An entirely different view is taken by Pagenstecher, who considers the muscular diverticulum an anomalous embryonal development—due to a superabundance of tissue. There are apparently no better proofs for the theory advanced by Pagenstecher than for the former.

Inflammation is a grave complication in case of diverticulum. Cystitis may be primary and extend into the sac, causing diverticulitis or *vice versa*. Most diverticuli have thin walls and little if any power of contraction. If the sac is dependent and the orifice of communication with the bladder small, stagnation is favored, and with inadequate drainage the pathologic process is progressive. Peritonitis or pelvic abscess may follow diverticulitis, and thrombosis of vessels may occur as reported in a case by Murchison.⁴³ A large diverticulum may compress surrounding organs and cause damage, particularly to the ureters, and in consequence to the kidneys, causing hydronephrosis, later by ascending infection pyelo-

nephritis and pyonephrosis. Calculi are at times found in the diverticula and cases of new growth in the sac have been reported by Targett,⁴⁴ Young,⁴⁵ and Perthes.⁴⁶

Symptoms.—A diverticulum may be present in the bladder without giving rise to symptoms, and it may be accidentally discovered postmortem. There is no pathognomonic symptom of this disorder, but the most characteristic one is perhaps that the patient after urination feels as if the bladder had not been completely emptied, and he is able almost immediately to repeat the act, voiding a considerable quantity. This is explained by Hodgson in the following way: The orifices of the vesical pouches are bounded on all sides by bundles of muscular fibres, very much hypertrophied. When the bladder is filled with fluid the hypertrophied muscle bundles are flattened out over the surface, and the orifice of the pouch is rendered patulous. As the urine is being expelled, the general muscular coat performs active contraction, its fibres aggregate themselves into separate bundles, which are gradually approximated to each other, those of them which bound the orifices of the pouches acting as sphincters and shutting up a certain quantity of urine, which is poured into the pouches in the reaction backward of the expulsive force due to the obstruction in front. Thus the diverticulum is filled with urine and its neck is simultaneously closed by contracting muscle bundles. After the urine has been evacuated from the bladder the contracting muscular coats relax and the urine confined in the diverticulum flows out.

Sometimes there is painful urination, particularly in large diverticula. In several instances tumor has been felt above the symphysis or per vagina or rectum. However, it is with the advent of complications, especially inflammation, that a diverticulum gives rise to symptoms. Cystitis and diverticulitis is the most frequent complication and is accompanied by the usual train of symptoms, *i.e.*, painful and frequent micturition of turbid, sometimes stinking, urine. Hæmaturia may appear early before diverticulitis is present, due, perhaps, to circulatory disturbances from distention. In my own case

there was early in the history a diverticulitis of a more chronic type, with periodical discharge of large quantities of slimy pus, followed later by an acute exacerbation. Sometimes, in a case of long standing, the secondary kidney disorder may overshadow the bladder trouble.

Diagnosis.—The introduction of a catheter immediately after the patient has urinated will usually disclose a considerable quantity of residual urine. By the aid of the cystoscope the opening into the diverticulum may be found, and a ureteral catheter may be introduced into the latter to roughly estimate the depth. If the opening into the sac is sufficiently large, the cystoscope can be introduced through it and the interior of the sac inspected. The diverticulum may be measured with my rubber bag as described above, and then palpated bimanually while distended. Radiographs taken in lateral and frontal view, after filling the bladder with a 5 or 10 per cent. collargol solution, are of the greatest value, especially where cystoscopic examination cannot be carried out.

Prognosis.—According to Englisch the mortality rate in cases of diverticulitis is 83.1 per cent. The results of palliative treatment and operative treatment other than radical operation have not been encouraging. In the fifteen cases radically operated upon there has been one death.

Sex.—Most cases of vesical diverticula reported have occurred in males, but there are several cases of diverticula in females on record. A very large diverticulum was found postmortem in a woman 59 years old, reported by Hofmohl.⁴⁷

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PRIMARY TUBERCULOSIS OF THE PENIS.*

I. A REPORT OF TWO CASES OF PRIMARY TUBERCULOSIS OF THE PENIS FOLLOWING NON-RITUAL CIRCUMCISION.

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II. NOTE ON PRIMARY TUBERCULOSIS OF THE FORESKIN.

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PRIMARY tuberculosis of the penis is a very rare condition. Many authors upon diseases of the genito-urinary system do not mention it at all. It is stated in Watson and Cunningham¹ that primary tuberculosis of the meatus, urethra, or glans probably does not occur, and that when the disease appears at these points it is secondary to other foci higher up in the urinary tract. Keyes² states that tuberculous ulcers may appear upon the glans, or result from infection during ritual circumcision. White and Martin³ state that tuberculous ulcers on the penis are extremely rare, and that they cannot be distinguished from chancroidal lesions by inspection. They have, however, a history of very slow extension; they are usually associated with tuberculous lesions in other parts of the body, sometimes exhibiting about the periphery of the ulceration grayish semitransparent miliary tubercles, and on microscopical examination of the scrapings of the lesion often show tubercle bacilli. Moreover, inoculation of guinea pigs will disclose the true nature of the lesion. They also state that a differential diagnosis can be made only by auto-inoculation; a valuable means of determining the presence

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or absence of the chancroidal virus, but one which is not infallible. Its value is perhaps best formulated by stating that the majority of chancroids will produce ulcers of a similar type in inoculation, while the majority of other ulcers, syphilitic, tuberculous, or inflammatory, will not produce such lesions.

Verneuil,⁴ in 1883, expressed the opinion that primary genital tuberculosis which did not depend on scrofula was probably caused by direct infection during coitus. Poncet⁵ reported, in 1890, to the French Congress for the Study of Tuberculosis an article on "Tuberculosis having its Origin in the Penis." He mentions three varieties: (1) balanopreputial tuberculosis; (2) tuberculosis of the mucous membranes, this variety usually showing itself first in the deep urethra; (3) tuberculosis of the urethra in the form of fungous masses involving the periurethral tissues.

Kraski⁶ observed on the dorsum of the glans penis of a patient aged forty-nine years an ulcer the tuberculous nature of which was demonstrated microscopically after removal.

Senn⁶ believes that in many cases of destructive lesion treated by amputation of the organ and in which no recurrence followed the operation, the disease was not carcinoma but tuberculosis. He reports the following cases:

CASE I.—John M., age thirty-one, with no history of a syphilitic infection. Ulcer first began on the external surface of the prepuce. There was no enlargement of the glands at the time. The ulceration and sloughing extended successively to the glans and body of the penis and finally resulted in almost complete destruction of the entire organ. Later the inguinal glands and skin covering the scrotum became involved. These glands became caseous and several well-marked tuberculous abscesses developed. The discharge from the extensive ulcerating surfaces resulted in inoculated tuberculosis which covered considerable of the gluteal regions on both sides. Some of the ulcers would heal from time to time, after which the new scar would again break down to give place to an ulcerated process. No signs of syphilis could be detected on any part of the surface of the body or in any of the internal organs. The patient was subjected repeatedly to anti-syphilitic treatment, preparations of mercury and iodine were given without improvement; in fact, such treatment aggravated the local conditions and still further impaired the general health of the patient. The patient was then placed

on anti-tuberculous treatment, local and general, consisting in the use of balsam of Peru followed by iodoform with repeated curettage and the internal administration of guaiacol and cod-liver oil. The disease was arrested, the ulcers healed rapidly, and the general health so much improved that the patient resumed light work.

CASE II.—Emil S., single, white, florist, German, age twenty-one years. In this case the lymphatic glands in the groin became involved, after a considerable portion of the penis had been destroyed by ulceration and sloughing. Syphilis was suspected, but most energetic treatment made no impression on the progress of the disease. Local and general anti-tuberculous treatment with complete excision of all the infected tissues effected a speedy and permanent cure. The tissues were examined for tubercle bacilli with negative results, but isolated multinuclear giant-cells were found.

The diagnosis of tuberculosis upon the evidence set forth in the two preceding cases cannot be accepted as positive. Multinuclear giant-cells are also found in syphilis and would not aid in the diagnosis. Senn bases the strongest argument for the diagnosis of tuberculosis in the fact that rigorous anti-syphilitic treatment not only failed to arrest the disease, but resulted in aggravation of the local conditions and impairment of the general health of both patients, while the anti-tuberculous treatment yielded the most prompt and satisfactory results.

The great majority of cases of primary tuberculosis found in the literature have arisen from ritual circumcision. The ceremony⁷ may be briefly described as follows:

The rite is performed among the Jews by a Mohel or surgeon, and may be divided surgically into three parts.

1. The Milah: The child is placed upon the grandfather's lap, the Mohel grasps the prepuce, draws it forward and places it in a slit shield, and cuts it off with a single stroke of the knife.

2. The Periah: The inner lining covering the glans is then stripped back with the thumb and index-finger of each hand until the glans is exposed.

3. The Mezizah: The Mohel takes some wine in his mouth and applies his lips to the penis, exerts suction, spitting the blood and wine into a receptacle; the hemorrhage is afterward

controlled. This was commonly practised by Jews until some years ago, when at Krakow a great number of children were infected with syphilis. It was traced to a Mohel who had contracted the disease; and after this the use of a glass cylinder was introduced, so that the Mohel should no longer touch his lips directly to the wound.

The following cases of tuberculosis following ritual circumcision have been collected from the literature:

MELECOT⁸ reports the following case:

A Jew, age fourteen years, was circumcised when eight days old according to ritual. The ulcer was first noticed when patient was thirteen years of age on the glans penis circumscribing the meatus. The edges were dentated and slightly discolored. The base was pale and smooth, there was no formation of pus, and there was no pain on pressure. The patient's face was pale, there was emaciation, but no pulmonary lesion was found. The patient was taken to the Pasteur Institute, and fragments of the ulcer were removed and examined for tubercle bacilli; none could be found. The fragments were then mixed with 4 c.c. of sterile water and guinea pigs were inoculated; these developed tubercles. When the case was seen one year later, the ulcer was in the same condition but the general condition was better.

LINDEMANN⁹ reports two cases as follows:

The operator, the same in both cases, came from a tuberculous family and died of the same disease two months after infection of his cases. The cases are as follows:

R. S., parents healthy. Circumcised on the eighth day after birth. Wound healed within two weeks except a small area near frenum, which developed irregular edges and a cheesy base in which miliary tubercles could be seen. The ulcer was healed, but the buboes were removed and pus and cheesy matter evacuated. Recovery followed, but at the age of three years spondylitis developed with compression myelitis, and death followed from phthisis.

L., this case was identical with the first case. However, at the age of one year a cold abscess developed over the wrist.

LEHMANN¹⁰ reported ten cases, all inoculated by the same operator, who died afterward of phthisis. Of these cases six infants died, three of tuberculous meningitis, one of marasmus, after suffering an entire loss of the skin investment of the penis from gangrene, one from sepsis, and one from an intercurrent disease, diphtheria.

HOFMOKL¹¹ reports a case as follows: Infant circumcised when eight days old; seven weeks later an ulcer developed by the side of the frenum, with a bilateral suppurative adenitis. No tubercle bacilli were found, and anti-syphilitic treatment was begun. This treatment was without effect. The ulcer was then curetted and the glands removed.

On section they showed tubercle structure, and the bacilli could be stained. This patient recovered.

ELSENBERG¹² reports the following case: S. P., aged five months. Ulcer developed near frenum, with infiltration extending into the prepuce. The inguinal glands were very much enlarged, and the overlying skin was livid, boggy, and perforated. The discharge from the sinuses was watery and contained flocculi. Later an abscess developed behind the mastoid. Mercury was prescribed without effect. The wounds remained open, and a temperature of 104° F. developed. Death took place from sepsis. No postmortem could be obtained, but section of the prepuce and glands showed tubercles and tubercle bacilli. The same author reports three other cases which recovered.

WILLY MEYER¹³ reports a case as follows: Infant born in Roumania, ritually circumcised, came to this country at seven months of age. The parents said the child had been treated for syphilis since the disease started. This treatment was continued for a month longer without results, and then all diseased areas were removed. On section the specimen showed tuberculous tissue and tubercle bacilli. Recovery followed in this case.

KAREWSKI¹⁴ has reported three cases; one died of sepsis.

MARTIN W. WARE¹⁵ reports the following case: C. M., an infant three months of age, born of healthy parents, circumcised according to ritual when one week old. The wound did not heal, but became inflamed, and the inguinal glands enlarged. The child was placed on anti-syphilitic treatment for two weeks without effect. The right inguinal glands became very much enlarged, and, in the site of circumcision, an ulcer with irregular edges developed. The base contained flabby granulations, with a scant secretion. The rectal temperature rose to 103° F. The ulcer was then curetted, the buboes incised, and an ounce of pus removed. The anti-syphilitic treatment was continued. The wound became worse, the penis enlarged, and a lymphangitis, starting from a small yellow nodule, developed from its dorsum. The diagnosis of tuberculosis was then substituted for that of syphilis, and later confirmed by section of the inguinal glands, which showed distinct miliary tubercles.

DOBROVITS¹⁶ also reports a case of tuberculous ulcer following circumcision according to ritual; and in a similar case reported by Perlis,¹⁷ complete destruction of the penis took place.

The following case has been reported by Dr. SARA KALT-KAKELS:¹⁸ Baby, age six months, breast fed, born of healthy parents who had one other child, three years of age and healthy. Was circumcised according to ritual at nine days. The wound was sucked by the operator, who was an elderly man and who had followed his occupation for thirty years. He had a cough, and presumably had tuberculosis. After the operation the wound inflamed and the surrounding part became red and swollen. The child became feverish, and suffered from a slight dyspeptic disturbance. About four weeks later the mother noticed a swelling in the left groin. A physician was then consulted. He prescribed an oint-

ment, but no improvement followed. The child was later taken to Mt. Sinai Dispensary. At this time the child showed a small hydrocele on the right side and a glandular swelling in the left inguinal region. Some weeks later the woman returned, and the prepuce of the child looked at this time œdematous, and there was a slight nodule to be felt in the periphery. Fluctuation was detected in the glandular swelling. This was aspirated and a thin serous discharge mixed with flocculi escaped. A suspicion of tuberculosis was then entertained, and Pirquet's was positive. Dr. Eugene Paul Bernstein examined the discharge from the sinus and reported the presence of tubercle bacilli. Later the enlarged suppurating glands were removed by Dr. Charles Goodman, and the pathological examination showed tuberculosis. The baby was well fed, weighed 19½ pounds, and looked rosy and healthy. The temperature was normal, thoracic organs were normal except a few râles over the lungs, the spleen was slightly enlarged, and there was a deep sinus in the left inguinal region, which was gradually filling up with healthy granulations.

The two cases of primary tuberculosis of the penis which I desire to report followed non-ritual circumcision, and are examples of wound infection by the tubercle bacilli. Both cases were carefully studied by Dr. A. S. Warthin, Professor of Pathology of the University of Michigan, and the diagnosis of tuberculosis made after section of the removed tissue.

The cases are as follows:

On April 16, 1902, J. S., thirteen years of age, and younger brother, American by birth, family and personal history negative, were circumcised non-ritually by the same surgeon, at the same time and at the same place, where just previously an operation on a tuberculous patient had been performed by the same surgeon. At the end of a week the wounds had almost healed, and both cases were dismissed as cured. Fifteen days later both boys noticed a marked swelling of the tissues of the penis, posterior to the glans, in the line of the incision of the operation. In the case of J. S., the swelling continued until it became the size of a hen's egg. The swelling was opened at various points by the attending physician, and pus was evacuated, and flax-seed poultices were applied. On May 26, 1902, the patient was admitted to the hospital of the University of Michigan. At the time of admission most of the swelling of the penis was on the ventral aspect of the organ. No fluctuation could be detected. The small

incisions about the line of circumcision gave off a small amount of yellow pus. There was swelling in the region of the epididymis of the left side about the size of the little finger, soft, but not painful, and the glands of the inguinal region became swollen, but not tender.

Dr. C. G. Darling, Clinical Professor of Surgery of the University of Michigan, dissected away as far as possible the diseased tissues, curetted the granulating surfaces, and brought the edges together with black silk. The tissue was sectioned, the diagnosis of tuberculosis was made by Professor A. S. Warthin. The patient was discharged, cured, July 4 of the same year.

The younger brother was operated privately by Dr. C. G. Darling. The ulcer was curetted after removal of the diseased tissue and treated in the same manner as the first case. The ulcer healed after the first operation, and the patient was discharged as cured. The diseased tissue was sectioned and showed tuberculosis. Bacilli were found in small numbers. The diagnosis in this case was also made by Professor Warthin.

At the present time, nine years later, both boys are living and well, and have shown no signs or symptoms of tuberculosis since the operations occurred.

CONCLUSIONS.

First. That though primary tuberculosis of the penis is comparatively rare, it is probably more common than might be judged from the literature.

Second. It is possible that many cases of primary tuberculosis of the penis have been mistaken for syphilis, chancre, and cancer.

Third. That tuberculosis following ritual circumcision is less common at the present time than formerly, and no doubt due to changes in the ritual; and that the practice of suction should be abolished.

Fourth. The two cases which I have just reported are due to unclean surgery. The tubercle bacilli were evidently carried from the patient who had been operated upon just previously to the wounds of both circumcised patients by unclean hands or improperly sterilized instruments or other

articles used in the operation. Both cases are examples of wound-infection by the tubercle bacilli. That both boys were well and had at no time shown any symptoms or signs of tuberculosis up to the time of operation; that the parents were both well; that the operations were performed by the same surgeon, at the same place and time; and that preceding the operations a tuberculous patient had been operated, leave no room for doubt concerning this mode of infection.

II. NOTE ON PRIMARY TUBERCULOSIS OF FORESKIN.

Since Dr. Wilson's report was written one case of primary tuberculosis of the foreskin has been sent to this laboratory for examination.

CASE 749-N.—Private patient of Dr. D. M. Cowie, young adult, teacher, good family and personal history. No other evidence of tuberculosis. No sexual exposure. Personal habits and character beyond suspicion. No known possibility of infection. Small, painless nodule developed upon the foreskin. Circumcision by Dr. Cowie.

The mucous surface of the foreskin presented a flattened induration about 1 cm. in circumference and 5 mm. in thickness. There was no ulceration. On microscopical examination, the indurated area was found to be composed of a mass of typical miliary epithelioid tubercles with caseating centres and giant-cells. The histologic appearances were in no way like those of a chancre; the individual tubercles stood out sharply with relatively little inflammatory reaction about them; the main portion of the mass being made up of confluent miliary tubercles. The epithelium was intact; and the process was more subepithelial, that is, deeper than a chancre. A nerve ending and a relatively large nerve-trunk lay in the middle of the mass of tubercles. Some of the neighboring veins contained organizing thrombi. The epithelioid areas were completely avascular; and, as a final proof, tubercle bacilli were demonstrated in numbers in the caseating centres. Small beginning tubercles were also found in the walls of the neighboring veins. The largest area of caseation contained numerous polynuclear leucocytes and showed central softening (abscess formation). No other organisms were found, however.

The case must be regarded, therefore, as a very rare instance of the localization of tuberculosis in the foreskin, as a primary process, independent of any local injury. The depth

of the process and the vascular involvement make me regard it as most probably a hæmatogenous infection, and not one derived through the mucosa. In the absence of tuberculous lesions elsewhere in the body, or at least of lesions that could be recognized, the process would have to be regarded as a cryptogenic hæmatogenous infection. When last heard from the patient showed no other signs of infection, and the local wound healed promptly.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, Held at the German Hospital, New York,
October 25, 1911.*

The President, DR. CHARLES L. GIBSON, in the Chair.

MEMBRANOUS PERICOLITIS.

DR. OTTO G. T. KILIANI presented a man, 28 years old, whose chief complaint was pain, of a "burning, pulling, or dragging" character, in the right lower abdomen. He was constipated, vomited frequently, and had lost weight. He gave a history of having had an appendectomy done four months ago.

Examination showed a scaphoid abdomen, soft, without rigidity. There was a scar in the right lower quadrant, with slight tenderness to the outer side of it. The colon was distended, movable, and easily palpable. A series of X-ray pictures, taken after the ingestion of a Rieder's bismuth meal, showed a dilatation of the colon, and at the end of twenty-eight hours a considerable part of the bismuth paste remained in the gut.

Operation: The colon was exposed through a right rectus incision. It was found freely movable and sharply pinched at its hepatic flexure, descending for a distance of a few inches and then turning upward and across the abdomen. It was bound down here and there by many adhesions and covered with newly-formed connective tissue. The adhesions were separated and the colon anchored with chromic gut sutures to the lateral abdominal wall. The abdomen was then closed in separate layers.

LOCAL BLOOD INJECTION FOR UNUNITED FRACTURE.

DR. KILIANI presented a man, 29 years old, a chauffeur. In April, 1911, he was struck by a car, sustaining a fracture of both bones of the right leg at their lower third. He was treated at the Roosevelt Hospital for several weeks, and then came to

the German Hospital, where a plaster case was applied. He returned to the hospital six weeks later, at which time Dr. F. Kammerer sutured the fragments of the tibia with two silver wire sutures.

An examination made on Sept. 1, 1911, showed that the fractured tibia was still ununited. The patient's leg had been in an extension apparatus, in plaster; he had received Bier's hyperæmic treatment, massage, and mild active motion. The patient was then given 10 c.c. of venous blood, injected into the line of fracture. A similar injection was given on Oct. 7, 1911, and the slight false movement of the fragments diminished decidedly. He left the hospital on Oct. 26 on the road to complete recovery.

DR. HENRY H. M. LYLE said that in the past four months he had seen three cases of non-union after the use of Lane's plates. In two of these cases the plating had been done for non-union.

He had used "Bier's blood injection" with excellent results. Last year he had shown before this Society a case of non-union of both bones of both legs. This case had exhausted all the ordinary orthopædic and surgical methods, yet union was obtained by the injection method in four weeks.

The results in this case and in others had convinced him that this method should always be tried before resorting to the use of Lane's plates. Dr. Kiliani's striking result had deepened this conviction.

DIVERTICULUM OF THE ŒSOPHAGUS DUE TO CARCINOMA.

DR. KILIANI presented a man, 68 years old, who about ten months ago first noticed difficulty in swallowing, and for the past five months he had been unable to eat any solid food and swallowing gave rise to pain in the neck. There was no history of vomiting, but he regurgitated his food frequently. There was no blood in the stools. The patient had lost eight pounds in weight.

An examination of the neck showed atrophy of the thyroid gland. The thyroid cartilage stood out prominently, and there was a gurgling sound when the patient swallowed. One of the submaxillary glands on the right side was enlarged and hard. A No. 16 French bougie could be passed into the stomach; a No. 22 failed to pass, meeting with an obstruction eight and a half inches from the teeth.

On August 24, 1911, a gastrostomy was done by Dr. Fisher by the Carter-Senn method, and about a month later he made an

incision, six inches long, beginning at the top of the sternum and extending obliquely outward on the left side to about the level of the larynx. The œsophagus, in this location, was found to be normal, but below it became lost in a hard tumor mass which extended downward and backward to the vertebral column. It was apparently malignant, and no attempt was made to remove it. The omohyoid muscle, which had been previously cut, was reunited, and the wound was closed with silkworm gut.

ISOLATED FRACTURE OF THE TRANSVERSE PROCESS OF THE FIRST AND SECOND LUMBAR VERTEBRÆ.

DR. KILIANI presented a man, 33 years old, who complained of a sharp, stabbing pain in the right kidney region, radiating across the back to the opposite side. There was also a constant aching pain on the right side which radiated to the shoulder. The patient denied luetic infection. He gave a history suspicious of pulmonary tuberculosis; otherwise, his personal as well as his family history was negative.

The patient stated that his present history dated back three weeks. He said that four days ago the pains in the back became more severe, and that two days before admission they were "maddening," so that they would double him up. He had vomited several times. There was no blood in the urine; no frequency; no "sand."

In addition to the above history, it was subsequently elicited that seven months ago the patient had fallen a few feet, landing on his back. Following this fall, he had not complained of any pain or inconvenience. An examination of the abdomen was practically negative, and cystoscopy revealed nothing abnormal. Posteriorly, there was a point of tenderness on the right side, two inches from the median line, at about the level of the crest of the ilium. In forcibly landing on his heels, he experienced a severe pain. Bending forward was not limited, but on assuming the erect posture he experienced a severe "catching" pain. Backward motion of the spine was slightly limited; otherwise, motion was not interfered with.

A diagnosis of fracture of the transverse process of the first and second lumbar vertebræ was made, and the exact location of the fracture was verified by the X-ray. Firm strapping of the parts gave the patient only partial relief, and after this method of treatment had been tried for about three weeks, the loose fragments of bone were removed by Dr. Kiliani, with entire relief.

TUMOR OF THE BRAIN.

DR. KILIANI presented a man, 51 years old, the history of whose illness dated back ten years, when he began to complain of headache and weakness in different joints, especially on the right side. He also had a sense of numbness in the fingers, sudden lapses of memory, and periods of semiconsciousness. He had perfect control of the bladder and rectum. There was no history of vomiting. His vision had gradually become impaired until he was scarcely able to recognize objects. Hearing was normal.

Upon admission to the German Hospital, on June 23, 1911, an examination gave the following chief points of interest: His pupils were equal and reacted sluggishly both to light and accommodation. The fields of vision were contracted, especially the lower, and acuteness of vision was diminished. There was no nystagmus; no paralysis of the extrinsic muscles. There was distinct muscular weakness on the right side of the body; no areas of anæsthesia, but sensation was somewhat impaired. There was no muscular inco-ordination. The knee-jerks were exaggerated, the right more so than the left. There was no Romberg; no Babinski. With the exception of sight, the special senses were not impaired. There was no facial paralysis nor anæsthesia. There was double choked disk.

At a subsequent examination, made on October 12, 1911, the abdominal reflexes on the right side were found to be absent. The Babinski reflex was present on the right side and the knee-jerks were exaggerated. Muscular weakness was marked on the right side, while the sensory reactions on that side were diminished. There was no tremor. The patient was emotional, and subject to fainting spells and attacks of petit mal. There was motor aphasia. No nystagmus.

Dr. George Jacoby made a diagnosis of left-sided brain tumor, starting in the white substance, possibly involving the thalamus and extending outward to the cortex. A decompression operation was done by Dr. Kiliani on October 30, 1911, followed by considerable improvement in the patient's symptoms. Radical removal of the tumor was considered impossible.

SPASTIC HEMIPLEGIA WITH SPONTANEOUS RECOVERY.

DR. KILIANI presented a girl, three years old, who was admitted to the German Hospital on June 30, 1911, with the

history of having been shot in the back with a 42-calibre revolver bullet. The wound of entrance was found in the lumbar region, half an inch to the right of the median line and extending upward and to the left in an oblique direction.

The history obtained was that after receipt of the injury, the child's left side was completely paralyzed. When Dr. Kiliani first saw her, in August, 1911, the only symptoms that remained indicated a partial paralysis of the muscles of the left lower extremity. The leg was flexed and abducted. The patient was now able to raise her foot a few inches from the bed.

EXTREME RECTAL PROLAPSE CURED BY OPERATION.

DR. FREDERIC KAMMERER reported the case of a woman, 29 years old, upon whom he had operated for a very large rectal prolapse a year and a half ago. The patient had been under his care for over six months, but he had been unable to trace her lately and could not, therefore, speak definitely of her condition to-day.

In the course of her treatment, various plastic operations had been done on the perineum and in the sacral region, the last one being a colopexy, with partial denudation of the left iliac fossa and suture of the sigmoid to the area stripped of its peritoneal covering (denormant), a procedure which had apparently given permanent results in several other cases. In this case, however, six weeks after operation, the patient had a fall while still in the hospital, resulting in a renewed prolapse of the entire rectum. The speaker now resorted to the method described by Quenu and Vidal of obliterating the cul-de-sac by two purse-string sutures, and suturing the bowel to the posterior surface of the broad ligament and the left iliac fossa. As an additional safeguard, he had fastened the uterus to the anterior abdominal wall, which procedure, he believed, was not included in the method of Quenu and Vidal. There had been no recurrence during the period of observation mentioned above.

DR. A. V. MOSCHCOWITZ said that very recently one of the house surgeons of Mt. Sinai Hospital had called his attention to the operation of Quenu and Vidal for prolapse of the rectum, a description of which was published in the *Revue de chirurgie*.

Dr. Moschcowitz said that through the courtesy of several members of the Society he had been fortunate in seeing a goodly

number of cases of prolapse of the rectum during the past four or five years. In his earlier cases he did the operation from below, dividing the sacrum and getting at the prolapse by that route. This method was not always satisfactory, and during the past four years he had practically followed the method by Quenu and Vidal, closing up the cul-de-sac of Douglas. In women, he first separated the peritoneum, which gave a far better result than by merely closing the cul-de-sac, and in some of these cases he also added a fixation of the uterus high up.

Dr. Moschcowitz in conclusion said, that he had not as yet read the article in question, and on that account did not wish to enter into a discussion of priority; but he would like to mention at this time that his first case was done nearly four years ago.

DUODENAL ULCER.

DR. KAMMERER presented a man, 33 years old, who had developed all the classical symptoms of stenosis of the pylorus. At the operation, the first portion of the duodenum was found firmly bound down by adhesions, posteriorly, with a stellate cicatrix on the anterior surface, about half an inch from the pylorus. A posterior gastro-enterostomy, done six months ago, had relieved all his symptoms.

Dr. Kammerer also presented a man, 25 years old, who had had a history of eight years' duration, pointing to an ulcer in the duodenum. In this case there were no symptoms of stenosis at the outlet of the stomach. The patient had finally drifted into a state of chronic invalidism, with great emaciation. At the operation, which was done not quite a year ago, an indurated area on the anterior surface of the first portion of the duodenum was found. There were no adhesions. A posterior gastro-enterostomy, followed by a unilateral exclusion of the pylorus, was done. The latter was accomplished by section of the stomach, about an inch and a half from the pylorus, with closure of both ends (Von Eiselsberg).

The patient had gained forty pounds in weight since the operation, and was free from all symptoms. The speaker thought this exclusion, whenever practicable, was preferable to simple infolding of the ulcer by sutures. Where there was no stenosis, some form of closure of the pylorus ought to be practised.

DIVERTICULUM OF THE GALL-BLADDER.

DR. KAMMERER showed a woman of 48 years, who came to the hospital with a well-marked recurring cholecystitis. The operation revealed a rather unusual condition. On opening the abdomen, extensive adhesions were found to the enlarged and very much thickened gall-bladder. After liberating the body of the gall-bladder, a hard, irregular, spherical mass, an inch and a half in diameter, could be felt, resting against the cystic duct on the one side, and firmly adherent to several coils of small intestine on the other. It gave the impression of an enormous gall-stone in migration from the gall-bladder to the intestine. With considerable difficulty the intestines were separated from the mass, a ligature passed around the cystic duct, and the gall-bladder removed with the mass *in situ*. The latter consisted of a shell of calcareous matter, from one-sixteenth to one-eighth of an inch in thickness, with a fairly smooth inner surface, which on microscopic examination proved to be a lining of mucous membrane, the interior being completely filled with a substance of waxy consistency, uniformly tinged with bile. There was, however, no communication between this cavity and that of the gall-bladder proper, at least not at the time of operation, nor could any indication of a previous communication be found.

RESECTION OF THE ŒSOPHAGUS AND LARYNX FOR CARCINOMA.

DR. KAMMERER presented a man, 45 years old, who had been suffering from increasing difficulty in deglutition until he was scarcely able to swallow anything, solid or liquid, and was in a condition of marked emaciation. The stomach tube was arrested at a point corresponding to the cricoid cartilage, and a distinct mass could be felt by external palpation of the neck.

A preliminary gastrostomy was done, and two weeks later, through an incision along the anterior border of the left sternomastoid muscle, the constricting mass in the œsophagus was exposed. In the course of the operation, the entire laryngopharynx and about two inches of the œsophagus proper, the entire larynx, and the left half of the thyroid gland had to be removed. The stump of the trachea was sutured to the skin above the sternum, the pharynx above, the œsophagus below were closed by sutures, and the prevertebral wound cavity was partially tamponed with gauze. The patient bore the operation well,

and was now, six months later, in a much improved general condition.

DR. WILLY MEYER showed a series of cases illustrating the end results of various operations after the lapse of from three and a half to ten years.

PERICARDIOTOMY.

The patient was a man, 34 years old, who had been operated on at the German Hospital three and a half years ago. Upon admission to the hospital, the patient was suffering from intense dyspnœa, cough, night-sweats, and œdema of legs. A diagnosis was made by Dr. J. Kaufman of effusion into the pericardium. This was aspirated by Dr. Meyer, and about a quart and a half of dark-colored fluid was withdrawn. This procedure gave only temporary relief, and a week later he was again tapped, and about a quart of fluid evacuated. The relief again was only temporary, and six days later, under local anæsthesia, the sixth and seventh costal cartilages were resected, the pericardium was incised, and over two quarts of fluid evacuated. The heart itself could not be seen until a large number of black coagula were removed. After this there was immediate improvement in the patient's symptoms. Convalescence took nearly five months. The case was considered to have been one of tuberculous pericarditis, and the patient was sent to Liberty, N. Y., where he had remained ever since, and where his health had become entirely restored. (See ANNALS OF SURGERY, 1909, vol. xlix, p. 261.)

IMPLANTATION OF SILVER FILIGREE FOR INTRACTABLE ABDOMINAL HERNIA.

The patient was a woman, now 53 years old, upon whom the operation had been done ten years ago, and who had already been shown at one of the previous meetings of the Society. The history dated back twenty years, when at some other hospital the patient had her uterus removed, and the resulting wound was drained with gauze. Following this, a large ventral hernia resulted. She also had a diastasis of the recti above the umbilicus. She was subsequently operated on by Dr. F. Lange, who buried silver wire and silkworm gut sutures, and she remained well about a year and a half.

The patient first came under Dr. Meyer's observation eleven years ago, with a large abdominal hernia, the aperture being between the umbilicus and symphysis; it was too large to be closed by autoplasty; therefore the omentum was pulled down and stitched to the borders of the defect. An abdominal bandage gave sufficient support to enable the patient to attend to her work as cook. About one year later, during an attack of acute intestinal catarrh, a severe vomiting spell tore the omentum loose and the hernia returned. A few months later Dr. Meyer implanted a silver wire filigree imported from Germany. It healed in nicely after a sinus resulting from a fascia necrosis had closed under treatment with pure carbolic acid. The patient seemed entirely cured and could be discharged without a truss in spite of her large pendulous abdomen. Nine months later, on turning suddenly, she knocked this very spot against the corner of a kitchen sink and almost fainted. Examination and subsequent operation showed that the filigree had been broken in its centre but that otherwise it was properly in place. An additional filigree was made during the operation which permanently cured the trouble. She now has been wearing these filigrees for ten years; she has never worn an abdominal supporter and the hernia has never returned. Recently, Dr. Meyer operated for the diastasis of the recti above the umbilicus which had returned in spite of a second operation done by another surgeon. The muscles were separated almost up to the xiphoid process and could not be brought together, and he made a typical filigree with cable silver wire in course of the operation. This hernia, too, seems to be definitely cured.

Dr. Meyer stated that he had done quite a number of operations for defects of the abdominal wall as well as for intractable herniæ by means of silver wire implantation. He emphasized the advantages of the cable silver wire over the German wire. The former is very flexible and does not break so easily. Temporary sinuses, he stated, are best treated with suction cups.

RESECTION OF THE ASCENDING AND TRANSVERSE COLON FOR CARCINOMA.

DR. MEYER showed this patient, upon whom the operation had been done in November, 1905, six years ago. The patient was a woman, then 57 years old, who had been treated for a long time for cholecystitis, and who had suffered for years from pain

in the region of the hepatic flexure. The diagnosis of cancer of the colon was made. Incision through the right rectus showed a large, infiltrating carcinoma, involving the ascending and part of the transverse colon; ileocolostomy was done with the elastic ligature, and the abdomen closed. Five weeks later, median incision; resection of the tumor and inversion of the divided gut on either side of the well functioning anastomosis. She made an uninterrupted recovery, gained rapidly in weight, and, as far as the colon is concerned, has been well ever since. In November, 1908, the speaker had to remove a tumor of the bladder of this patient, which proved to be carcinoma. Bladder and abdomen were closed by layer sutures and a permanent catheter was placed in the urethra. The patient was discharged at the end of two weeks and is to-day in perfect health.

SPLÉNECTOMY FOR SPLENIC ANÆMIA.

This patient was a man, 41 years old, whose spleen had been removed three and a half years ago. He had been extremely low, and direct transfusion was done by the house surgeon, Dr. Ottenberg, in January, 1908. The effect, though favorable at first, was not lasting. In March of the same year splenectomy became necessary, and was done with the help of osteoplastic resection of the costal arch. The tail of the pancreas (about one-third of the organ) had to be excised with the spleen. The patient made a perfect recovery; and has remained in good health since, being able to attend to his work.

This observation again proves that splenic anæmia is a surgical disease curable by operation. (See ANNALS OF SURGERY, 1909, vol. xlix, p. 258.)

CRANIOTOMY FOR FIBROSARCOMA OF THE AUDITORY NERVE.

The patient was a woman, 23 years old, who was operated on over three and three-quarters years ago, in January, 1908 (ANNALS OF SURGERY, 1908, p. 309, and 1909, vol. xlix, p. 552). She had shown all the typical signs of brain tumor, and had been almost blind, as pointed out at one of the previous meetings. The operation was done in one sitting; a large horseshoe shaped skin muscle flap, which later on had to be divided in the middle, was turned down, thus exposing the occiput. The entire occipital bone was removed, the longitudinal sinus doubly ligated and

divided, and the dura mater opened by a heart-shaped incision, the flap being turned down. The cerebellum, thus made movable, was held aside by the brain elevatorium, when in the depth the bluish-gray tumor came nicely into view. It was shelled out with Kocher's "Kropfsonde"; the wound was carefully drained. The dura mater flap could not be brought into apposition again with the upper border on account of the bulging brain, but the skin muscle flap was sutured in place. The patient made a perfect recovery. To-day she shows the signs of a typical decompression operation and wears a leather-covered aluminum plate for protection. She is able to walk alone on the street for long distances, can read and write and do embroidery work, and makes herself generally useful in the household. There is no sign of a recurrence.

PARTIAL GASTRECTOMY FOR CARCINOMA IN A PATIENT 24 YEARS OLD.

The patient was a man, who had entered the hospital greatly emaciated with typical signs of pyloric obstruction; stomach analysis did not point to carcinoma. On opening the abdomen, a large infiltrating tumor was found at the pylorus and many glands alongside the larger curvature; none at the lesser one, near the pylorus, but further away up toward the cardia; it was most difficult to remove the latter. Typical resection of stomach was done and posterior gastro-enterostomy with the button added. Recovery was uneventful. To-day the patient is in perfect condition, having gained considerably in weight.

In connection with this, Dr. Meyer mentioned another case which showed the necessity of resection of the ulcer-bearing area of the stomach whenever possible. He referred to a man at present in the hospital, in whom he had done gastro-enterostomy for pyloric obstruction two years ago. One gland was found in the major omentum on which the laboratory, after a few minutes, reported "no carcinoma." On basis of this, anastomosis was done. At present he is again in the hospital with an inoperable pyloric carcinoma.

SIMULTANEOUS REMOVAL OF RENAL AND URETERAL CALCULUS ON THE SAME SIDE.

The patient, 39 years of age, had had litholapaxy done twice and showed stone in the kidney as early as seven years ago, but

refused operation. This summer he again came under observation, with an immense, ramified stone in each kidney. On the left side there was in addition a ureteral stone. Dr. Meyer proposed an operation in two sittings on the latter side, as he considered it safer to first arrange for proper drainage of the kidney and then to operate on the latter. However, patient having no time to lose, insisted on a simultaneous operation. Consequently, after resection of the twelfth rib, the kidney was brought into view, pelviotomy was done, and the lower end of the stone broken off, on purpose. Then the section cut was added and the other ramified portion removed; finally, two smaller, separate stones were cut out of the parenchyma. There was no suppuration at all; the kidney tissue tightly embracing the calculus, it could be gently stripped off without much injury. The pelvis was sutured as well as either pole of the kidney, and the centre of the section cut drained; after proper dressing, the patient was turned around and extraperitoneal left ureterotomy added. The stone was found near the bladder (as the X-rays had demonstrated); after proper incision, it could be well developed; the ureter was then sutured. The patient made a good recovery, left the hospital in about three weeks and wants to wait—against advice—for the removal of the right renal calculus until next spring.

Here again the needle holder, the so-called "Küster's swan," as improved by the author and published in the ANNALS OF SURGERY, July, 1910, in a paper on thoracic surgery, proved of greatest advantage. Although, as it has been pointed out in an article by Wm. J. Mayo recently, that the ureteral wound can be left open in such cases, his patients having made good recoveries, it nevertheless seemed advisable to the speaker to close it. He stated that so far he had been able to close every ureteral wound of this kind, even in the closest proximity to the bladder. High Trendelenburg's posture and this needle holder allow the work to be done.

TRANSDUODENAL CHOLEDOCHOTOMY.

This patient, 25 years old, was operated upon in June, this year. She had had many attacks of biliary colic and became jaundiced early in May. Operation June 29: Rectus incision; cholecystostomy; stones removed; choledochotomy; removal of stones; one calculus low down could not be pushed up into the

wound in the common duct; duodenal incision. A stone was found tightly wedged in the papilla Vateri, half in the duct, half in the duodenum; duct incised; stone removed. A probe introduced through the choledochotomy wound showed patency of the duct; double layer suture of the duodenum; suture of the common duct; drainage of the gall-bladder. Patient made a good recovery and is to-day in perfect health.

THORACOTOMY FOR IMPERMEABLE CARDIOSPASM (TWO CASES) WITH REMARKS ON DRAINAGE AFTER INTRATHORACIC OPERATIONS.

DR. WILLY MEYER stated that a few months ago he had published in the *Jour. of the Am. Med. Ass'n*, a case of impermeable cardiospasm in a woman, 47 years old. She had a very large pouch above the diaphragm. Thoracotomy was done under differential pressure; both pneumogastric nerves were widely separated from the œsophagus and the latter's pouch reduced in size by a double plication. She made a perfect recovery and was shown before this Society last fall, having gained quite some weight. An interesting point in her history was that she had regained the power of swallowing solid as well as liquid food *without any further intervention*. Seven months later she went through a severe attack of influenza-pneumonia, and not long thereafter developed a thoracic œsophageal fistula, evidently due to one or more sutures having cut through the œsophageal wall. Silk had been used. She refused further operation on the thorax and died a year after the first operation, having retained the ability of swallowing up to the last. Postmortem showed the signs of a posterior suppurative mediastinitis.

Dr. Meyer now presented two further cases of the same kind. In both thoracotomy and single plication had been done with chromicized catgut. The first patient whose cardia had been frequently stretched by competent men, without gratifying results, was to-day well able to swallow his food, only that in the beginning of his meals he had to take a swallow of water and force the food down with the help of intrathoracic pressure.

In the second case, Dr. Einhorn had diagnosed an organic stricture at the cardia, probably due to a former ulcer, but inasmuch as during the operation the sound passed the cardia, although with some difficulty, a plasty was not done on the

cardia, but the operation as mentioned before. Patient made an uninterrupted recovery, but, functionally, he has not been much improved; he is able to swallow liquids, but no solids. It is the speaker's intention, now to first try stretching of the cardia and, if this should prove of no avail, to do a second thoracotomy and perform intrathoracic cardioplasty according to the v. Heinecke-Miculicz method of pyloroplasty.

Dr. Meyer stated that in almost every one of his operations on the œsophagus he observed that a cardia which is not occupied by a tumor could be easily pulled far into the thoracic cavity. He could see no reason why cardioplasty should not be done through the thorax. It certainly must be easier than to turn up the costal arch and work from the side of the abdomen, as Wendel has done.

In both of the last cases and an additional third one before, all three having been operated upon in the negative chamber in the course of May and June this year, Dr. Meyer tried a new method of thoracic drainage which he planned two years ago, at the time of preparing for the building of the new Thoracic Pavilion of the German Hospital. The same consists in closing the original thoracic incision and making another intercostal one in the complementary space for drainage with ordinary rubber drainage tubes. Thus proper exit is provided for the immediate secretion of the pleura as well as any air that may bubble out from a sutured lung wound, as for instance, after an accident. The compression of the lungs by fluid or air, with its possibly fatal consequences, may thus be avoided. Post-operative acute pneumothorax is prevented by continuing the patients under differential pressure for some time after operation, instead of sending them back to the ward. The head rests within the cabinet, where it can be easily reached by doctors and nurses who serve in relays, as the air lock permits of entrance and exit. The patient's body rests comfortably on a bed without head piece, of same height as the operating table. All kinds of stimulation, as rectoclyses and hypodermoclyses, intravenous infusions and hypodermic injections, can be given outside, and, of course, food can be brought to the patient. After having been removed from the apparatus, the patient is kept for about 24 hours in one of the two recovery rooms provided for, which are rather observation rooms, in order to determine whether a reapplication of differential pressure is required.

It is self-understood, that in aseptic cases the thoracic incision is closed without drainage.

Dr. Meyer then demonstrated Tiegel's thoracic metal-drainage tube, as published in the *Centralblatt f. Chir.*, early this year, which he had lately imported. He also mentioned the method of Robinson for the treatment of empyema, who perforates the rib and screws in a snugly fitting trocar cannula, siphon or suction drainage then being established. It is evident, that this procedure can also be used for drainage after intrathoracic operations.

He further referred to the proposition of Green and Jane-way, who lately have come forward with a plan of thoracic drainage in experimental surgery, similar to that of his own.

He pointed out, that in the method advocated by himself, the after-treatment of the thoracic wound does not differ from any other wound treatment. He believes that it can be employed with any kind of differential pressure apparatus—provided its use does not require general anæsthesia—inasmuch as his observations so far have shown that a continuation of differential pressure for 12 to 15 hours after the operation suffices to form adhesions between pulmonic and costal pleuræ, strong enough as to permit of the patient's removal from the apparatus.

The manner in which the drainage after intrathoracic operations at the German Hospital is done was then demonstrated during a walk through the new pavilion for thoracic surgery.

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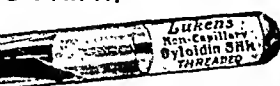
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No. 3

ORIGINAL MEMOIRS.

INDICATIONS FOR AND AGAINST THE OPERATIVE TREATMENT OF SIMPLE FRACTURES.*

BY JOHN H. GIBBON, M.D.,

OF PHILADELPHIA,

Professor of Surgery in Jefferson Medical College; Surgeon to the Pennsylvania Hospital.

WHAT I have to say on this important subject will probably cause my readers to place me among those who oppose the operative treatment of simple fractures; and although I should prefer this to being classed with those who recommend operation in practically every case, yet a careful consideration of what is said I believe will show that I belong in neither class. There has been so much written on the open treatment of simple fractures, and the technic has been so much improved lately, that I am afraid we have become too sanguine in regard to our results and too radical in both our teaching and practice. It is important to bear in mind that what follows has to deal only with simple fractures.

The first desideratum in the treatment of a fracture is the restoration of function, and the first step in accomplishing this objective is complete reduction and retention of fragments. Although improper reduction is one of the chief causes of loss of function, injury of the surrounding soft parts and the resulting adhesion of muscles and tendons is just as potent a factor, and when the open treatment is employed there must be more or less injury and adhesion of

* Read before the Philadelphia Academy of Surgery, December 4, 1911.

these structures, which will be in proportion to the mechanical and technical skill of the operator and the perfection of his asepsis. It is extremely important to bear these facts in mind before undertaking the open treatment of a simple fracture.

There are, of course, certain indications for the open treatment which we all recognize and follow, unless they are outweighed by equally positive contraindications, which will be considered later. In the first place, the situation of the bone or the type of the fracture may be a sufficient indication for operation; this is the case in fractures of the patella, in many fractures near a joint, in an epiphyseal separation which cannot be perfectly reduced, in some comminuted fractures, in those where a muscle or tendon or other tissue is interposed between the fragments, where a nerve-trunk has been caught under one of the fragments, and in all fractures where a fair reduction has not been obtained *after the exhaustion of all rational non-operative means*. Emphasis is laid on this last condition, especially with students and those who look too lightly upon the risks of operative treatment. I say this because it is the beginner or the occasional operator who is often willing to run risks which the most experienced operator never runs, and neglect precautions which an experienced operator always takes.

One of the most valuable lessons which experience teaches is the estimation of risks and the value of precaution. It is the tyro whose boldness causes him to operate where an experienced surgeon recognizes danger, and it is the tyro who considers the refinements of an aseptic technic unnecessary or even looks upon them as fads. It is this type of surgeon who will operate on a fracture without having exhausted the less dangerous non-operative means of reduction, and one reason why he does so is because he sees many worse cases operated on successfully by others. It may be said that this applies to the whole field of surgery, and so it does, but I hold that it applies particularly to the open treatment of fractures, where success depends so largely on the operator's mechanical skill and his practice of an aseptic technic.

A conscientious practice of the rule of exhausting the non-operative means of reduction will obviate the necessity of operation in many so-called irreducible fractures. To prove this statement, one has but to consider a few types of fracture for which operation is frequently employed. First, let us take fracture of the surgical neck of the humerus with abduction and external rotation of the upper fragment, a fracture which by the older methods of reduction and retention gives but a limited restoration of function and a very indifferent restoration of contour. A mistake commonly made here is that of trying to control the short upper fragment, which is practically uncontrollable, instead of placing the lower fragment or shaft in alignment with the displaced and uncontrollable upper fragment. In many of these cases the simple abduction of the arm with moderate traction even without an anæsthetic will result in an excellent reduction, which can be maintained by dressing the part in abduction on a triangular splint placed against the chest wall, the inner aspect of the arm, and the flexor aspect of the forearm; or by keeping up extension in the abducted position by placing the patient in bed and applying a Buck extension apparatus to the arm. Too frequent an error in these cases is that of fixing the arm against the chest wall and applying a bandage, usually a Velpeau, which makes upward pressure on the flexed elbow and downward pressure on the shoulder; in other words, a dressing which tends to crowd the fragments into angulation or to retain them in this malposition. Traction applied to the elbow with the arm against the chest wall also often corrects the deformity when operation may seem to be necessary. In a number of these cases where there was extremely bad position of the fragments, we have obtained a fair reduction and excellent restoration of function by keeping the patient in bed with an extension on the arm in the abducted position for a week or ten days, and then dressing the part on a triangular splint.

Transverse fractures of the humerus with overlapping can nearly always be reduced by continuous traction applied

to the flexed elbow, with fixation of the arm to the chest wall while the patient is in the upright position, or, what is better, by keeping the patient in bed and applying extension by means of a Buck apparatus. Counter-extension should be made, of course, by elevating the foot of the bed and fixing the upper arm to the head of the bed by means of a pad and strap passed under the axilla. In the oblique and spiral fractures of the humeral shaft, the type of fracture which most frequently requires operative fixation, the large majority can be reduced by the method just described. If it fails, probably due to the interposition of the soft parts, then operation is plainly indicated. The necessity for operation in supracondyloid and fractures of the condyles can often be obviated by the proper employment of the Jones position, which gives excellent functional results, although not such perfect contour as can be obtained sometimes by other forms of dressing and by operation.

Many fractures of the olecranon require operation because of the wide separation of the fragments and the extensive laceration of the ligaments. But here the simplest means possible should be employed; catgut suture of the ligamentous tissue, as in fracture of the patella, may be sufficient, and a plate in this position is seldom excusable.

In certain fractures of the shaft of the radius and of both bones of the forearm, we encounter some of our greatest difficulties, and may be driven to operation or to accept some deformity with considerable loss of function. In four or five such cases within the past twelve months I have been surprised and gratified to find what can be accomplished by continuous traction extending over a period of from two to ten days. One of the cases at the Jefferson Hospital, X-ray plates of which are shown, was most obstinate (Figs. 1 and 2). My assistant, Dr. Despard, twice tried under ether anæsthesia to reduce this fracture, but the overlapping radial fragments could not be put into line. He then applied a Buck extension apparatus below the fracture, fixed the upper arm to the head of the bed, and elevated the foot of

the bed. This treatment, kept up for three days, had little apparent effect on the deformity, and the boy was then anæsthetized with the understanding that I would operate if failure again accompanied efforts at reduction. The treatment done so much to overcome and stretch the muscles that without much effort reduction was accomplished, and the boy, now eight months after the injury, is playing on a football team, has perfect function, and it is impossible to tell by examining the arms which was the seat of fracture. In another case of overlapping of both bones of the forearm sent into the hospital from the out-patient department, where various efforts had been made at reduction and in which about ten days had elapsed since the injury, treatment by continuous traction for about two weeks resulted in fair reduction and good union. The ultimate restoration of function I have been unable to determine in this case. Other cases have responded much more quickly to the treatment, but these two were cases in which operation seemed inevitable, even after traction had been kept up for several days. This method of overcoming the indications for operation will not work in every case, but it should be tried faithfully before resorting to the open method, which certainly does not give its best functional results in fractures of the forearm and makes a scar which is disfiguring, especially in women. The bones here are closely surrounded by important structures which are apt to become bound down in the cicatrices; the bones are delicate and do not put up with the plates and screws so well as the more deeply situated and larger bones.

The femur is the bone upon which we most frequently have to operate, and yet as the results here cannot always be expected to be perfectly satisfactory, we should by every possible means try to obtain reduction before operating. In children, especially, persistent effort and time will do wonders in restoring the bone to approximately normal lines, and the functional results are often excellent even in the presence of considerable deformity. I have nothing particular to offer here as a means of avoiding operation in the adult, but I would

call attention to the fact that in fractures of the upper third of the femur which are so troublesome because of the difficulty of controlling the upper fragment, extension in the abducted and elevated position has not been given one-half the employment it deserves. Most of us use this position in children, but many fail to realize its advantages in the adult. I have had as many as three of these cases in my ward at the Pennsylvania Hospital at one time upon which I have operated, but since I have used the extension with a little more care and discrimination, and less according to rule, I have operated on fewer cases.

Of fractures of the patella I shall say but a word, as I believe that the indication for operation is clear if the fragments are separated, since bony union of the patella and good healing of the lateral ligaments will rarely take place without it. I have never operated on a fracture of the patella without finding the ligamentous tissue firmly adherent over one or the other of the fractured surfaces. The contraindications will be referred to later.

In fractures of the tibia of the oblique and spiral types, operation is frequently demanded, and yet I am confident that too many of these cases are submitted to operation, especially at the hands of inexperienced men, where better results could be obtained by non-operative methods. I admit that continued improvement in technic may cause me to change my opinion and practice, but I speak now rather from the point of view of a teacher of undergraduates. Greater care, personal effort, the proper use of extension, and constant watching of these cases, which we are apt to turn over to entirely inexperienced internes, will certainly keep out of our operative lists many of these cases. Here, particularly, the operator should understand that if after exposing the fragments he can reduce and maintain them in reduction by a proper dressing, he should not employ a plate or other mechanical device applied directly to the bone, as such is badly borne by the tibia on account of its thin covering. Non-union, especially where the position is bad, is a definite indication for operation, but the best operative results are obtained when

the operation is done early; that is, as soon as it is evident that reduction cannot be accomplished. The open treatment of a Pott's fracture is rarely required except in old neglected cases, and here again the situation is not one suited to the use of a plate, the simpler methods of suture, nailing, etc., being better. The word "neglected" is used advisedly, because in the large majority of cases reduction can be accomplished and maintained with the expenditure of but a moderate amount of care. A certain proportion of Pott's fractures apparently heal in good position, and then the deformity recurs after the patient begins to bear his weight upon the part, and it is this type of case which is most frequently submitted to operation. The redevelopment of the deformity can easily be avoided by following a suggestion made by Mr. Robert Jones, of Liverpool, who, when the patient begins to walk, sees that the inner portion of the heel and sole of the shoe is slightly raised; this gives the ankle an outward turn and prevents stretching of the recently healed ligaments. If every patient upon leaving our wards is instructed to have his shoes altered in this way for six months, there will be fewer cases operated upon in the future than in the past.

Just as I have tried to show that continued traction will often result in reduction where spasmodic and intermittent traction will not, Crile has suggested that with deep anæsthesia, which causes complete muscular relaxation, our attempts at reduction will be far more successful than when we simply employ the anæsthetic to the point of relief from pain and the production of unconsciousness.

The contraindications to the operative treatment may lie in the fracture itself, in the patient's general condition, or in the operator and his surroundings. The contraindications to be found in the fracture itself are few, if, after careful and intelligent effort, reduction has not been accomplished and enough deformity exists to interfere with subsequent use or to distress the patient by its appearance. Local disease and infection of neighboring structures may preclude operation. I have at the present time a fracture of both bones of the forearm, in which there is an infected wound communicating

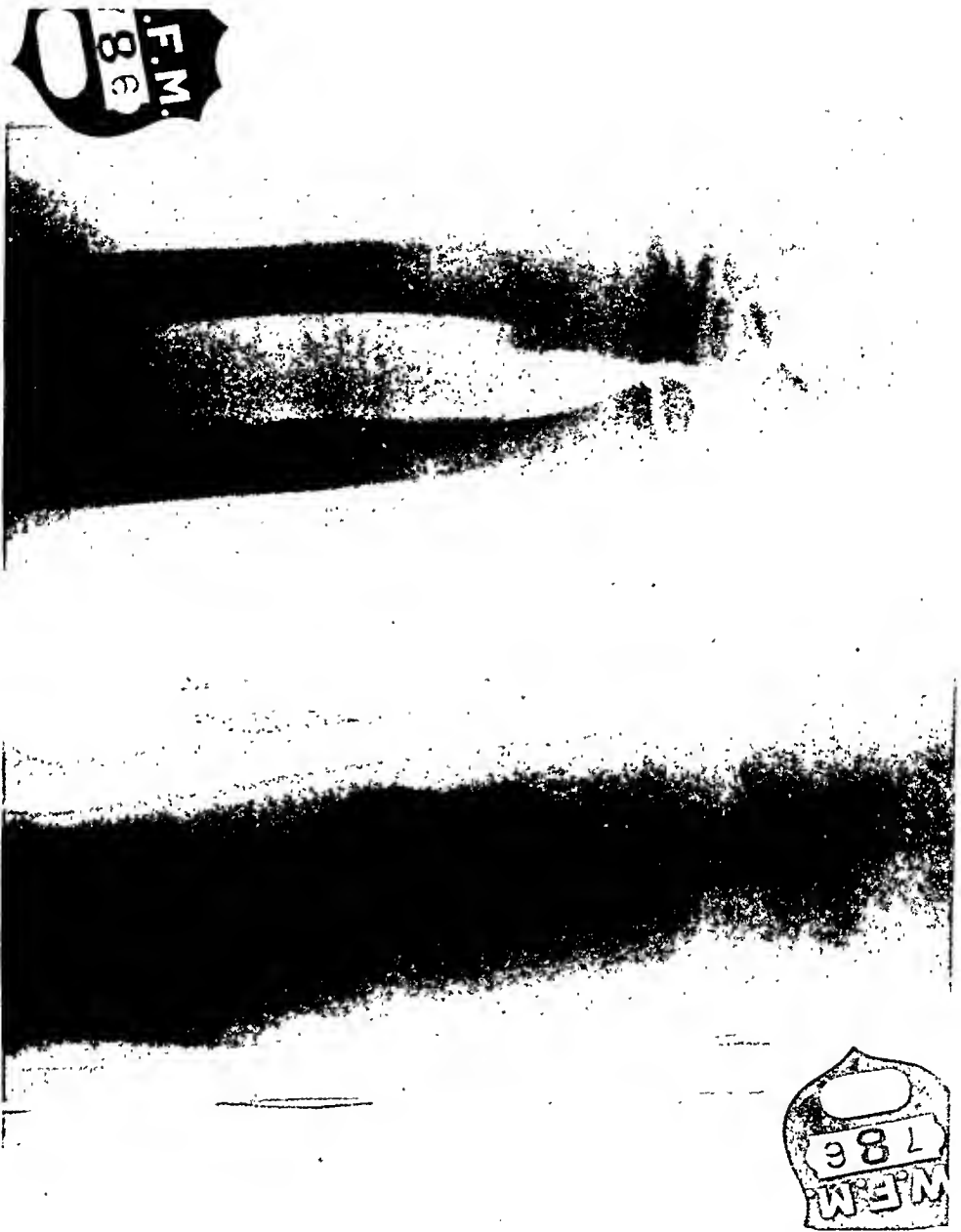
with the ulna, which is in excellent position, and I am prevented from operating on the radius, the fragments of which are overlapped, because of the infection in its neighborhood.

The indications against operation to be found in the patient's general condition are those which would make one hesitate to perform any operation of election. All these, however, must be considered carefully, and they should often make us refrain from operation on a broken bone when we might operate for some other condition in which infection is less likely to occur, more readily overcome, or less disastrous in its results. A drain may, for instance, save another structure from infection, but we have learned that it has no place in the open treatment of simple fractures, rather inviting than preventing infection. My experience has taught me to look upon chronic alcoholism as a contraindication deserving of great attention, as is also an old syphilitic infection. The extremes of age may often constitute a contraindication, old age because the operation is more dangerous, and childhood because nature does so much in the subsequent growth of the bone to overcome the deformity resulting from fracture. The ultimate results secured in children, even where reduction was but partially obtained, were clearly shown in a series of pictures recently exhibited by Dr. Edward Martin before the Philadelphia Academy of Surgery. The accompanying picture (Fig. 3) of a spiral fracture of the femur in a five year old boy is one in which I expect to get a good functional result, even though I may fail in correcting the position. Such a fracture in an adult I should probably be obliged to subject to operation.

I also show plates of a bad fracture of the femur in an adult, when, in spite of the displacement of the fragments, an excellent functional result without apparent limp was obtained (Fig. 5).

The contraindications to be found in the operator and his surroundings I would emphasize. There are probably but few surgeons who operate upon fractures with the same impunity and confidence that they perform other surgical operations of an apparently more serious nature. If this is true, it behooves us to know the reason. First, I take it, the

FIG. 1.




Fracture of both bones. Radius unreduced after two attempts under anæsthetic. Readily reduced after continuous traction of three days.

FIG. 2.



Same case as Fig. 1, eight months after injury.



Patient admitted to Pennsylvania Hospital November 27, 1911. Discharged January
18, 1912.

FIG. 4.



Same case as Fig. 3, taken ten weeks after injury. Excellent functional result.

FIG. 5.



Patient admitted to Pennsylvania Hospital December 17, 1911. Discharged February 8, 1912, on crutches.

FIG. 6.



Same case as Fig. 5, taken one week before discharge. Shortening 2.5 cm. Excellent functional result.

required mechanical skill is of a different sort from that necessary to the successful performance of most of the surgical operations, even of the most delicate character, and this is acquired only by careful study of the methods in vogue and by much experience; again, more care is necessary in this field than in any other to avoid infection, as we are dealing with a tissue, the medullary portion of the bone, whose resistance is slight; and still further, it may be said that failure of the operation often leaves the patient in a worse state, a greater cripple, than if no operation had been done. No one realizes these facts more fully than he who does the greatest amount of work in this field, and consequently when we are inclined to imitate the accomplishments of others, we should see that we are equipped at least to some extent as they are, and by equipment I do not mean the special instruments which are, however, most essential, but rather with ability to meet and deal with difficulties and with an aseptic habit and an environment which can be relied upon. If we could feel the same assurance regarding aseptic wound healing in fractures as we do in abdominal operations, half of the difficulties of this work would be overcome, and our results would be ten times better than they are at present. We are apt to minimize our percentage of infections in any type of operation, but I ask a careful study of our own cases and the perusal of any honest report by others, and we will then find that this important question of infection takes first rank when it comes to the open treatment of fractures. In a recent article on this subject, Lund, modestly describing himself as a beginner, reports eleven cases in which he has used the Lane plate, and in four of these he was obliged to remove the plate. If a man of his experience and ability finds this work difficult, it then becomes those with less experience and ability to move in this field of surgery with judgment and precaution.

In concluding this rather discursive paper, I would say that our aim should be to overcome the indications for open treatment by a perfection of our mechanical measures, and to obtain better results when we must operate by improving our operative technic.

THE TREATMENT OF SIMPLE FRACTURES: A STUDY OF SOME END RESULTS.*

BY JAMES MORLEY HITZROT, M.D.,
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THE presentation of this subject to the society has been prompted by the diverse opinions now existing regarding the question of open operation or conservative reduction in the treatment of recent simple fracture.

The whole question received its present impetus from the presentation of the subject of open operation in recent simple fracture by Mr. Lane.¹ While admiring Mr. Lane's able presentation of the purely operative side of the treatment of fractures, as well as his eminently successful results, it did not seem to the writer, from his experience, that one could safely subscribe to all of Mr. Lane's conclusions—and especially to that one which states that, "accurate or anything approaching accurate apposition of the displaced fragments in a fracture was obtained in only very rare cases by the various non-operative methods."

Bloodgood² quotes Lane as stating that the end results of the non-operative treatment for fractures are uniformly bad except in the hands of experts, and gives as his (Bloodgood's) opinion that more cases will be submitted to operation when publicity has forced better methods of treatment for fractures upon the profession.

Stimson³ takes the opposite view from that elaborated by Lane, and sounds a warning of the dangers of the open method of treatment. Stimson bases his opinion upon the success obtained by him with non-operative methods.

Freeman,⁴ in a discussion of the subject, takes what might be called a middle course between the above divergent views, and states, that by operating in well-selected cases better results can be obtained. He goes even further and gives a list of fractures with what he would consider the

* Read before the New York Surgical Society, Dec. 13, 1911.

method of election in their treatment. The clavicle and transverse fractures of the long bones should be treated by conservative methods; avulsion of the tuberosities of the tibia, humerus, and os calcis; fractures of the surgical neck of the humerus with dislocation or rotation of the head of that bone; fractures of the humerus just above the elbow-joint; and spiral fractures of the long bones should be treated by open operation. Fractures of the olecranon and patella, he considers, occupy an intermediate position—some cases without separation being best treated by conservative measures while operation is indicated in all cases with separation of the fragments. At the elbow-joint every fracture should be operated upon when satisfactory replacement of the fragments, as shown by the X-ray, cannot be accomplished otherwise.

Quoting Freeman further: "The success of operative intervention depends much upon the accessibility of the fracture, the danger varying directly with the amount of manipulation required; that faulty alignment and overlapping of the fragments do not mean disturbance of function, and, that in carefully selected cases it must not be forgotten there are two important drawbacks to operative intervention, namely, infection and delayed union."

If one can state these divergent views clearly Lane advocates nothing but operative treatment for simple fractures. Certainly one obtains such a belief from his papers.

Stimson favors the non-operative replacement of displaced fragments in all cases where this is possible, and limits operative interference to a very carefully selected class of cases in which operation offers a more suitable result, weighing carefully all the dangers coincident to that operation. In his book "Fractures and Dislocations" Stimson,⁵ admits the propriety of operative interference when the fragment has been drawn into the muscle, and when the displacement in articular fractures, if uncorrected, may seriously interfere with the usefulness of the joint. As little relief is to be expected by a late operation, the operative treatment must be carried out while the injury is still recent, *i.e.*, within the first 24 hours, with this reservation, "but I am convinced it should be resorted

to only after thorough study of the conditions and careful weighing of the probabilities."

In the reservation of Stimson and in the selection of Freeman, we find what may be considered the solution of some of the phases of this question. Extreme views pro or con rarely lead to a clear understanding of any subject, and such statements that only operative interference can produce the desired result cannot safely be subscribed to, nor can Bloodgood's belief that more cases will be submitted to operation when publicity has forced better methods of treatment of fractures upon the profession be allowed to pass unchallenged. Credit should be given these gentlemen for attracting the attention of the profession to the necessity of better and more careful treatment of fractures. That fractures should be handled by experienced individuals to procure the most favorable result should be axiomatic. Much of the present disability occurring in uncomplicated fractures is due to neglect or to a lack of experience upon the part of the medical attendant. No method, however perfect, will succeed if improperly carried out in any of its details, and the too ready assumption of ability to treat any and all fractures on the part of the inexperienced lays the profession as a whole open to sharp criticism emanating from Mr. Lane.

The crux of the entire question seems to be in what is to be most desired in the treatment of fractures, accurate anatomical reposition by open methods or approximate alignment as shown by the X-ray, with restoration of function to a degree sufficient for all practical purposes. If proper exact reposition anatomically is the only means toward the restoration of the above degree of function, and replacement can be obtained only by open operation, no surgeon of experience should hesitate to operate. But if satisfactory restoration of function, even in the face of what is not exact anatomical replacement, is possible by simpler, less dangerous methods, open operation should not be the method of election.

Deformity and disability are not always the result of improper replacement. Fractures of the lower end of the radius (Colles) may be completely replaced, yet crushing of the

spongy lower end may so shorten the radius that the level of the two styloids is distinctly altered, the lower end of the ulna becomes prominent, the wrist-joint wider, and some radial deviation of the hand self-evident; yet function may be perfect except for very slight limitation of ulnar deflection. The same may be said of fractures involving the upper end of the humerus. Anatomical replacement, judged by radiographs, may seem perfect, yet, due to impaction, some shortening is inevitable and complete abduction may be impossible and external rotation distinctly interfered with. The same traumatism may also set up coincident joint changes, which do not appear until later or after the healing of the fracture and the return of function has been quite satisfactory to the individual as well as his surgical attendant.

The following case may illustrate this condition more clearly:

The patient, J. B., a man forty-three years old, was admitted to Bellevue Hospital, Dr. Gwyer's service, 1907, with a history of having fractured his right shoulder three years previously by a fall against the curb. The arm was set at the Presbyterian Hospital and put up in plaster away from the body. At the end of three months his shoulder was moving nicely and he was able to return to his work as a painter. The mobility of the joint steadily improved with use and he had no trouble except stiffness in the morning. About five months after the injury, that is eight weeks after recovery, he noticed that his right shoulder-joint was slightly swollen, and about the same time he had some pain, especially when he used the arm overhead. This pain has slowly but steadily increased up to the present, and function has become more limited, so that the arm is at present nearly useless. There are no other phenomena of any importance and no history of other joint inflammations, etc., of any bearing on the case, and he had no previous injury or disease of the right shoulder except the fracture. On examination the right shoulder was found swollen to twice the size of the opposite shoulder. The swelling was symmetrical, there was no skin inflammation, and no tenderness on palpation. Pain on active motion, passive motion was very painful if carried to any degree, no crepitation, joint loose, capsule tense and fluctuant. The X-ray showed no bony change, a

perfect bone alignment, but a diffuse haziness about the head of the bone in the region of the distended capsule. On anterior incision, a villous arthritis with a clear straw-colored fluid was present in the joint. As much synovial membrane as was hypertrophied was excised. The bones and cartilage were normal. The pericapsular tissues were loosely closed, the wound drained subcutaneously from the lower angle and bound in a bulky dressing to the chest. The post-operative course was uneventful except for a thick, viscid synovial discharge for two weeks. The end result two years after operation was freedom from pain but a very restricted movement in all directions at the shoulder-joint in spite of massage, baking, passive motion by the Zander method, etc.

Personally the writer does not know what the gentleman could have done who obtained what the patient considered a good result nor is it clear how open operation could have in any way prevented the joint change.

Age must always play an important part in the result of any treatment for fracture. Extension fractures of the humerus (supracondylar) in children never give any disability and rarely any deformity, while the same lesions in the elderly result in marked disability even with perfect reduction without deformity.

Obviously it has not been possible to trace every case of any given type, as many have disappeared, but those which have been found are sufficient to give a fair idea of what the result in certain given types has been. Purposely many types of fractures have been omitted, such as fractures of the skull, of the bones of the face, of the pelvis, and fracture of the metacarpus and metatarsus and their phalanges, Colles's fracture, and cases of multiple injuries where the fracture or fractures had, in the original treatment, to be treated by the most expedient although often inefficient methods because of the patient's general condition—for example, crushing injuries of the chest and pelvis with fractures of both femora, etc.

The treatment has been the same in all cases of similar type, and the details will be given under the discussion of the type. One fact has become quite evident as the cases have been analyzed, viz., that early reduction before infiltration has

occurred has given the best results. When the fracture has come under observation after the infiltration has occurred, it has often been impossible to bring about satisfactory reduction even under anæsthesia. In such cases extension by a sufficiently heavy weight, with constant supervision, was tried until replacement became easy or was obviously impossible by such means. That the period of time for such extension should not exceed one week from its inception became more and more evident, for displacements in over-riding, which could not be pulled down in that time, have not, in the writer's experience, been benefited by longer traction (this of course does not imply that traction should cease or did cease when the result was satisfactorily accomplished). When, at the end of a week, traction did not seem to be likely to accomplish the desired result, the patient was anæsthetized and reduction attempted under ether, and fixation apparatus applied while suitable traction was maintained. Very little benefit resulted from this procedure except in a few cases. The results of these procedures were controlled by measurements and suitable X-ray pictures, and when the latter did not show satisfactory results operation was carried out, after all the factors, such as age, cardiovascular, renal, and other intercurrent conditions, with the accessibility of the fracture, were given due consideration. In operating no foreign material was used when avoidable, chromicized gut was used wherever available, and Lane's plates only where other methods did not seem likely to avail.

Of the many types of extension those advocated by Bardenheuer,⁶ the Hodgens splint and vertical suspension, were the most used.

Reduction under ether is always essential when there is no contraindication to that anæsthetic. In minor cases gas or gas and oxygen is preferable. In certain types, of which fractures of the shaft of the femur form the chief group, reduction under an anæsthetic often fails because of the inability to overcome the muscular pull, and in these the various forms of traction apparatus find their chief usefulness.

The author has used the following expedient for reduc-

tion under ether: Adhesive plaster is applied to the lower leg up to and above the knee as in Buck's extension. To the lower end of this is fastened a strong loop (three thicknesses of muslin), and this is put over the shoulders of an assistant, who, bracing his feet, leans backward, using the weight of his body for traction. A sheet folded lengthwise is passed under the patient and over the perineum and up over the body in the long axis of the body, and counter-traction made by the pull of a second assistant, who, holding both ends or passing the sheet around his body, braces his feet and leans back, using the weight of his body for counter-traction. This assures a steady pull without fatigue or the necessity of obtaining a fresh grip. (Dr. F. W. Murray, private communication, tells me that the above method of traction is one employed by Willelms of Ghent and was shown by Willelms at the recent International Surgical Congress at Brussels. The writer has been unable to find the published details, but claims no priority for a method which has doubtless been used by others.)

Of the many forms of retention apparatus, moulded plaster splints, made according to the method given by Stimson (*loc. cit.*) have proven the most satisfactory and have been used by the writer to the exclusion of all other forms of splint because of their strength, lightness, ease of removal and replacement.

Another too often neglected part of the proper treatment of fractures is the so-called after-treatment. Massage should be begun as soon as the callus is solid enough to prevent displacement and as soon as pain on handling has disappeared. Baking should be begun as early as the beginning of the second week. The time for removing the fixation apparatus is one of the niceties in the after-treatment, and no time can be specifically stated. In general, the earlier active and passive motion is allowed, within the limits of pain, the better the result. Obviously no weight should be borne by a bone or bones which are not yet solid without additional external support.

Hydrotherapy and electricity for the preservation of muscle tone and activity should never be neglected.

An X-ray picture is, in the large majority of cases, in no

wise essential for diagnosis of fracture, but is of invaluable aid as an adjunct in determining the result of a given method of reduction and retention, and should never be omitted. Since early reduction before infiltration of the soft parts has occurred has given the more favorable results, any lengthy delay for an X-ray picture should be avoided, reduction done, and the ray then requisitioned to control the result and this later act should be carried out without any delay. Too often such control pictures, measurements, etc., are left until only operation remains as a means of approximation of the fragments, although the picture for diagnosis is never overlooked.

Where operation is necessary, so many successful expedients have been proposed that the selection of any given type of fixation must, of necessity, be governed by the fracture in question. The writer uses no fixation apparatus when the two fragments can be held in alignment without it (manipulation is done with the bones in view). If possible only strong chromicized catgut is used, and where it seems likely to fail the method advised by Lane seems the most expedient. Intramedullary splinting and fixation by screws with outside plates are doubtless very successful in the hands of the originators, but the writer has found the above quite sufficient to meet the various conditions which have come under his care.

That the cases here have been selected may be criticized, but, admitting the criticism, the cases were chosen not because of their types, nor because the result may or may not have been favorable, but simply because the individuals in question had a more fixed and more easily found domicile and were not the birds of passage with the municipal lodging house or Mill's Hotel addresses. Any one who has tried to trace the latter class of individuals, especially in New York City, will appreciate the reason for such selection. Some cases by virtue of suits at law to obtain recompense for their injuries from employers, etc., have kept the writer from losing track of them.

CLAVICLE.—Twenty-seven cases of fractured clavicle were traced. Nine cases were in children 2, 3 (3 cases), 4, 5 (2 cases),

6, 7 years of age; 4 cases were in women (17 to 27 years of age); 14 cases in men (16 to 37 years of age). Type of fracture: In 4 cases the fracture was transverse, in the remaining 23 it was oblique. Seat of involvement: The middle third of the clavicle in all cases. Type of deformity: Upward and forward displacement of the outer end of the inner fragment, downward and inward displacement of the inner end of the outer fragment with over-riding of the fractured ends. Method of treatment: reduction was accomplished by placing the patient prone on the back with a sand bag between the shoulder-blades and a sand bag under the sacrum. In this position the ordinary Sayre dressing was applied and so adjusted after patient assumed the erect position that it kept the fragments as nearly as possible in the position obtained with the patient recumbent as described. After appropriate axillary and skin padding, a Velpeau bandage was applied and the above dressing kept on the patient for three weeks. Massage was then begun and the arm carried in a sling for one week longer.

Result: In all the cases there was slight deformity at the site of the fracture (*i.e.*, thickening with a visible angulation as compared with the opposite side and shortening of the clavicle of from 0.3 cm. to 0.5 cm. The shortening was less marked in the children and most marked in the men, and the same statement applies to the visible and palpable deformity. There was no disturbance of function in the arm movements of any of the patients. One woman suffered from rheumatism in the shoulder when the weather threatened rain, but localized the pain over the shoulder in general rather than over the site of the injury in particular.

HUMERUS.—*Fractures of the Surgical Neck* (141 Cases).—Sixteen cases of old fractures in this region sought relief from disability, but as the treatment was not begun at a time likely to give any reliable result, they are not included in the above figures. Seven other cases which died of intercurrent disease within three months after the injury and three cases reported by relatives as perfectly well with useful arms have likewise been excluded.

Of these 141 cases for analysis 2 were in children (7 to 9 years of age); 38 were in women (49 to 67 years of age); and 101 in men (45 to 79 years of age). Sixty-nine cases were fractures through the tuberosities, 70 were below the trochanter, 2 began well below the trochanter and ran upward through the greater tuberosity, separating it as a separate fragment from the

head and the upper end of the shaft. Of the 141 cases, 65 had displacement of the upper end of the lower fragment into the axilla, 67 were more or less impacted with penetration of the upper end of the lower fragment into the upper with crushing of the upper fragment (of these 63 had little gross displacement); 7 were clear-cut transverse fractures with varying amounts of internal displacement of the lower fragment, from that completely under the coracoid to practically none whatsoever, and the two, mentioned above, were irregular in type.

Type of deformity: Those cases with marked axillary displacement showed an obtuse angulation in the limb about half-way between the acromion and deltoid insertion. The impacted cases and other types had swelling about the deltoid region and shoulder.

Treatment: With the forearm flexed and held in a sling a modified Stromeier cushion was placed in the axilla for abduction, and adhesive plaster strips were applied from the level of the deltoid insertion to the elbow, with the ends extending below the level of the elbow for about six inches. To these ends a weight of from five to ten pounds was attached and allowed to hang for one hour. If reduction was then satisfactory, moulded plaster splints were applied. (The posterior splint should begin at the base of the neck and pass down the arm to the wrist on its posterior aspect, leaving the latter joint free. The anterior splint should begin at the vertebral column about the level of the superior angle of the posterior border of the scapula, pass forward across the shoulder cap of the posterior splint and down the arm to the wrist.) The weight and cushion should be kept in place during the application of the splints, and the width of the cushion should be sufficient to bring the bone in proper alignment. An X-ray picture was then taken. In cases where reduction was not satisfactorily accomplished in that time, the arm was bound to the chest and traction continued over night and the splints applied on the following day. One case, E. D., age nine, was operated upon. The fracture was eight days old and reduction under anæsthesia impossible. Through an anterior incision the seat of fracture was exposed and the line of fracture found to be through the shaft just below the epiphysis. The upper end of the lower fragment was mobilized and jammed into the cancellous lower end of the upper fragment, where it remained without any tendency to become displaced. Wound closed without drainage (splints

as above, X-ray photographs, Figs. 2 and 3, from Dr. Hartley's service, New York Hospital, 1908).

After-treatment: Massage was begun at the end of ten days and carried on every second day. At first the splints were kept on for five weeks, but as the writer gained confidence it was possible to remove the splints at the end of the third week. Passive motion was begun as soon as the swelling subsided, and active motion when the splints were removed, and the free use of the arm allowed at the end of the fifth week. Electricity (galvanic and faradic) begun at the end of the fourth week in the last 50 cases for the nutrition of the deltoid. (*Vide* the results.)

Results: The two children, one operative and one non-operative (Fig. 1), had perfect results with no limitation of motion. Both showed one-sixteenth of an inch shortening (measured from the acromion to the head of radius).

In the remaining 139 cases hyperabduction of 5 per cent. was lost in all except two cases. In one of these cases the arm could only be abducted about ten degrees beyond the horizontal (woman with an impacted fracture with no displacement); in the second case (also an impacted fracture with no displacement), hyperabduction was possible to half the distance of that on the normal side. In testing the degree of hyperabduction, the vertebral border of the scapula was marked with the arms at the side and, during the act of hyperabduction, the scapular border moved one-eighth of an inch further from the midline on the affected side than on the normal side, showing that the extra movement beyond a certain point was accomplished by an increase in the movements of the scapula.

External rotation of from 5 to 10 per cent. less than on the normal side was present in all cases.

In both external rotation and hyperabduction, the relative loss in motion was much less in those 50 cases in which the splints were removed earlier, active motion begun in the fourth week, and electrical stimulation applied to the muscles.

Pain was present in twenty-two cases, especially during barometric changes; 67 cases had some stiffness in the shoulder on arising, which disappeared when the arm was used.

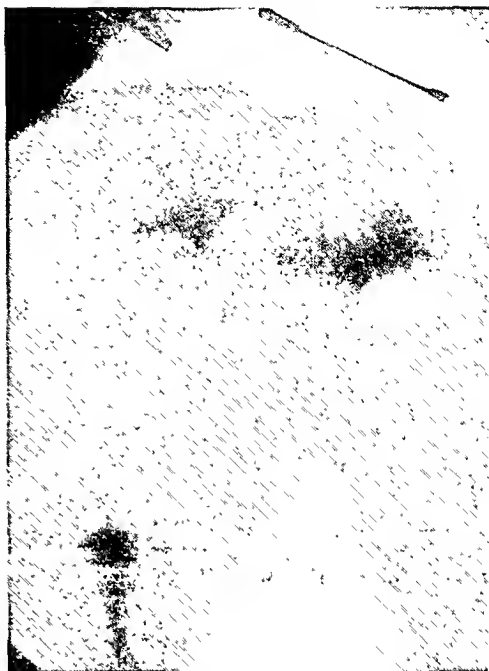
CASE I.—*Fracture at the Neck with Dislocation of the Head* (4 Cases).—John A., age forty-two, Bellevue Hospital, Dr. Gwyer's service, 1907. Fracture of the surgical neck with subcoracoid dislocation of the head of the right humerus (X-ray

FIG. 1.



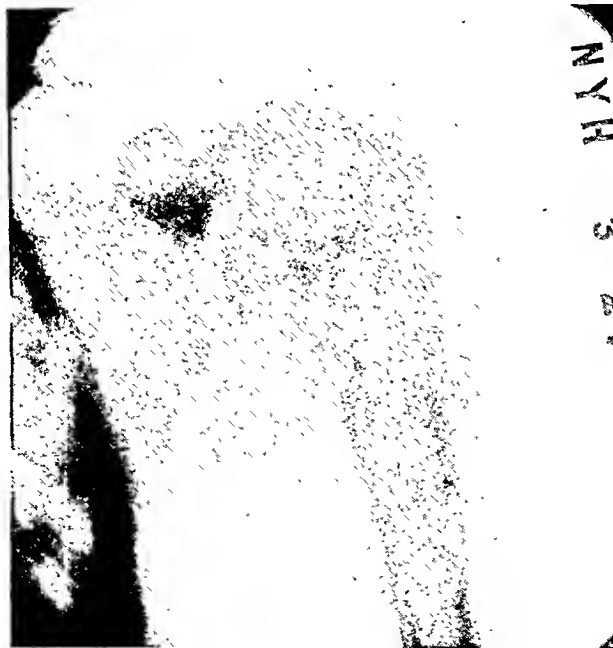
Result in fracture of the surgical neck of the humerus.

FIG 2.



Fracture of the surgical neck of the humerus before operation. (See Fig. 3.)

FIG. 3.



Fracture of the surgical neck of the humerus, after operation. (See Fig. 2.)



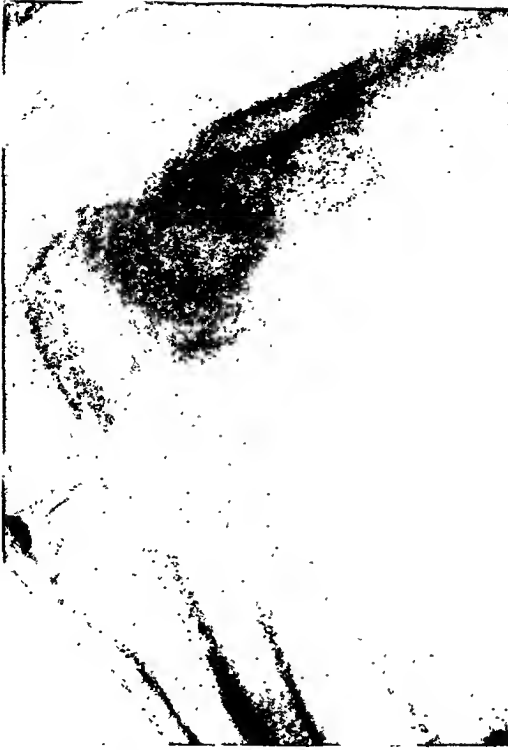
Fragment interfering with reduction; operation indicated. (From the service of Dr. F. W. Murray.)

FIG. 5.



Diacondylar fracture of the lower end of the humerus in an adult, before reduction.

FIG. 6.



Diacondylar fracture of the lower end of the humerus in an adult, after reduction. (See Fig. 5.)

FIG. 7.



Position of fragments after efforts at reduction of a fracture of the bones of the forearm in their upper third.

FIG. 8.



Result obtained by traction in a subtrochanteric fracture of the femur.

FIG. 9.



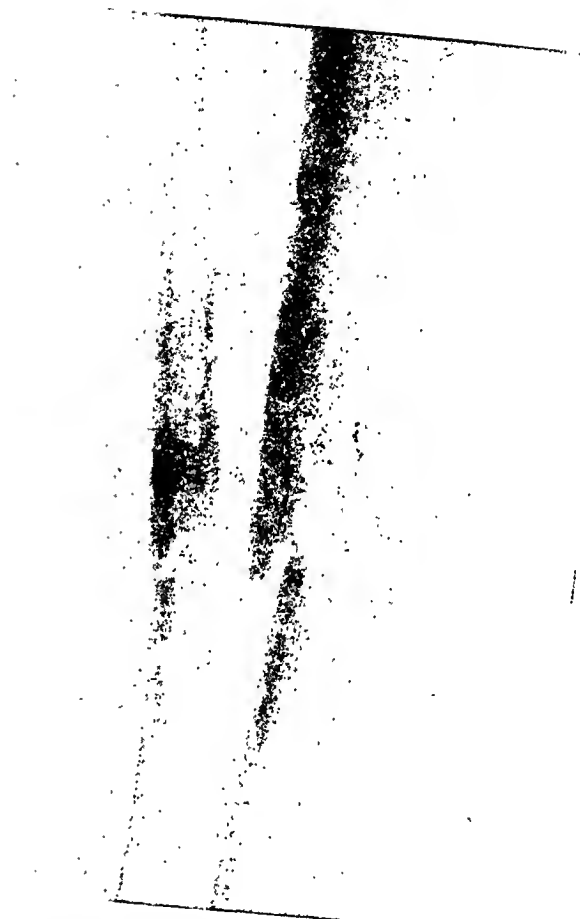
Result obtained by method described in for reduction of a fracture of the femur. (Ca John G.)

FIG. 10.



Result of reduction in a fracture of
the leg

FIG. 11.



Result of reduction in a fracture of the leg.

FIGS. 12 and 13.



Result of reduction in a spiral fracture of the tibia and an oblique fracture of the fibula in a child.

diagnosis). Operation refused. Patient was a Christian Scientist. Sixteen months after the injury shoulder was stiff, with no movement in any direction. There was marked weakness of all the muscles of the hand and forearm, with atrophy of the entire arm. The patient was satisfied with the result.

CASE II.—Harriet DeC., age forty, Bellevue Hospital, Dr. Woolsey's service, 1910. *Fracture of the anatomical neck of the left humerus with dislocation of the head into the axilla* (X-ray diagnosis). Removal of the head through anterior incision nine days after injury. Result: Limitation of motion at the shoulder-joint. Abduction to 75 degrees. Very little external rotation. The patient could just get her hand to the top of the occiput. There was no pain, the deltoid was atrophied, but there was no skin anæsthesia over the deltoid (three months after operation).

CASE III.—D. C. L., age forty-nine, Bellevue Hospital, Dr. Rogers's service, June, 1911. *Fracture of the anatomical neck of the humerus (left) with subcoracoid dislocation of the head. Splintering of the shaft of the humerus on its inner side.* Operation 16 days after injury. Anterior incision, attempt to replace head failed, head excised, moulded splints with the arm in abduction. Massage, passive movements, etc., at the end of the third week. Result: Six months after operation abduction to beyond a right angle, very slight external rotation. The patient is able to reach the posterior collar button with ease.

CASE IV.—Mrs. B., age sixty-three (reported by Dr. A. B. Johnson, *ANNALS OF SURGERY*, vol. li, 1910, p. 267). *Excision of the head for fracture of the anatomical neck of the left humerus with displacement of the head into the axilla.* Result: Nine months after injury, abduction to a right angle; very little external rotation; some pain after use of the shoulder.

Fracture of the Shaft of the Humerus.—Seventeen cases, all men ranging in age from 17 to 47 years.

Type of fracture: 10 cases were transverse or nearly so; 6 cases were oblique (with comminution in 1 case; 1 case was a spiral fracture).

Location: All were situated between the deltoid insertion and the supracondylar ridge, and gave no characteristic deformity other than over-riding and shortening of from one-half to two inches.

Treatment: Modified Stromeier pad in axilla, extension by adhesive plaster and weight, and moulded plaster splints (see

fractures of the surgical neck for detail). Massage was begun on the fourteenth day and the splints removed at the end of the fifth or sixth week, depending upon the solidity of the callus. In one case solid union did not take place until the tenth week. One case fell and refractured the arm through the callus in the tenth week, and the repair of this second fracture was not complete for fourteen weeks.

Results: In the ten transverse fractures function was perfect and no shortening was present. One case had slight angular deformity at the line of fracture due to insufficient abduction. The spiral fracture and two of the oblique cases showed one-eighth of an inch shortening. The other four oblique cases showed no shortening, a perfect alignment of the arm. In all these cases function was perfect. In the case in which refracture occurred, atrophy of the involved arm was quite marked. The difference in circumference, three inches above the olecranon, was two inches less on the affected side. This atrophy may undoubtedly be explained by the long period of disuse (19 weeks).

Fractures of the Lower End of the Humerus.—One hundred and six cases were in children from 1 to 10 years of age. Of these 52 involved the external condyle; 54 cases were supracondylar fractures; 34 cases were in adults from 20 to 74 years of age.

Fifty-one cases of fracture of the external condyle in children were all treated by hyperflexion with a moulded posterior splint or adhesive plaster and bandage for two weeks, when all fixation apparatus was removed and massage begun. One case (Mamie C., Bellevue Hospital, Dr. Woolsey's service, 1908) had rotation of the fractured fragment which could not be corrected and the broken fragment was removed by open operation. All had perfect return of function with no appreciable deformity. The 54 cases of supracondylar fracture in children were reduced under anæsthesia, and moulded plaster splints applied with the arm flexed to a right angle or slightly beyond it. To prevent the gun-stock deformity the writer has found a moulded posterior splint from the shoulder to the wrist with a U-shaped splint about the elbow, with that arm of the U over the inner side of the forearm placed a little more upward than the posterior limb of the splint, to be the most satisfactory.

Two of the cases had musculospiral paralysis and were operated upon, one four and one five weeks after the injury. In one of the cases, the musculospiral nerve was torn completely

apart just at the level of the fracture (Johnny C., 1910, House of Relief, Dr. Hartley's service. The ordinary end-to-end anastomosis was done, and nerve function as evidenced by the return of extension became complete in twenty weeks. In the second case (William S., New York Hospital, 1908, Dr. Hartley's service), the nerve was found flattened out over the line of the fracture, but its continuity was not severed. The nerve was freed from the scar tissue surrounding it. Function did not become marked until seven months had passed, and nine months after the injury was not as satisfactory as that in the first mentioned case.

Function at the elbow-joint was perfect in all cases. Fifty cases had no perceptible deformity, and arm tracings showed the same carrying angle for the two arms. One case had almost a straight arm in the extended position, and three cases had a perceptible change in the tracings with a diminution of the carrying angle on the affected side.

Of the 34 adult cases, 12 involved the external condyle; 11 were uncomplicated. In one there was a fracture of the head of the radius without displacement of the fragment. All were treated by flexion with a posterior plaster splint, but the degree of hyperflexion possible in children could not be obtained here. There was no deformity in any of the cases. Function was excellent but not perfect, extension was less complete by about five degrees and flexion by about ten degrees, the flexion being most limited in that case with concurrent injury to the head of the radius.

Six cases were fractures of the internal condyle treated by flexion and plaster splints after reduction under ether. The function was excellent in all cases, perfect in one. Extension and flexion were limited by from five to ten degrees in five of the cases. Widening of the joint with thickening of the lower end of the humerus was present in all cases.

Four were T- or Y-shaped fractures. Reduction was done under an anæsthetic and moulded splints of the type described in the treatment of fractures of the surgical neck were applied with the forearm flexed to, or slightly beyond, a right angle. Reduction was not satisfactory on the first attempt in any of the cases and had to be tried four times in one of the cases before the fragments were brought into suitable apposition. Deformity was present in all cases, *i.e.*, widening of the elbow-joint with

distinct anteroposterior thickening of the humerus and one-eighth of an inch shortening. Function: Flexion 20 degrees beyond a right angle and extension to 150 degrees in all cases. Pronation and supination of the forearm were perfect. One case had some stiffness in the joint in the morning, which disappeared as the arm was used. All do hard manual labor but find the injured arm sufficiently useful for all purposes.

In all of the above types baking and massage were begun on the tenth to the fourteenth day and active and passive motion, within the limits of pain, at the end of the third week, and all fixation apparatus was removed at the end of the fourth week. Full use of the arm was permitted in the tenth week.

One case (Henry W., Figs. 5 and 6, service of Dr. F. W. Murray, House of Relief, May, 1911) was a supracondylar (diacondylar) fracture in an old man seventy-nine years of age, and resembled that lesion as it occurs in children except that the articular fragment was displaced forward and inward. Under morphine $\frac{1}{4}$ gr. and gas and oxygen anæsthesia, reduction was done and a posterior moulded splint from the shoulder to the wrist was applied, with the arm flexed to a right angle. Flexion beyond this point caused the lower fragment to slip slightly backward and inward. Massage and baking were begun at the end of the first week, passive motion on the sixteenth day, and all fixation apparatus removed on the twenty-fifth day. No deformity was present, but after 6 months of baking and massage flexion was limited to about a right angle (occasionally the patient could bring the forearm beyond that point with the other arm). Extension was limited to 130 degrees and supination was just half that of the normal arm. The patient had "rheumatism" in the joint and very marked stiffness which took several hours to disappear. He had arthritis deformans in both hands, wrists, feet, and a very high degree of arteriosclerosis. The degree of functional disability, the pain and stiffness in this case, are worthy of comparison with the result of the same lesion in children, yet the X-ray showed perfect anatomical reposition of the fracture!

Eleven cases may be classified as extension fractures of the lower end of the humeral shaft. The line of fracture began just about the level of the epicondyles and ran upward and backward obliquely to varying levels. All were in men and all presented the characteristic deformity of this type.

Seven were reduced under anæsthetic, four by traction by adhesive plaster and weight and abduction (Stromeyer pad; see method for surgical neck and shaft). After reduction the same moulded plaster splints were applied as in fracture of the surgical neck of the humerus with flexion of the forearm to or just a trifle beyond a right angle. In none of the cases was absolutely perfect end-to-end alignment obtained, the lower end of the upper fragment over-riding and projecting beyond the line of fracture of the lower fragment to a very slight degree. In all cases massage was begun at the end of the second week. Solidity occurred in all but one case by the end of the sixth week. The latter became solid in the ninth week. There was no visible deformity in any of the cases, one-sixteenth to one-quarter of an inch shortening (the majority being one-eighth of an inch short). Function was perfect in every case.

RADIUS.—There were 29 cases of fracture of the head and neck of the radius. Of these 19 involved the head and 10 the neck.

In 15 cases of *fracture of the head* there was but little displacement of the fragments. In four cases the fragments were displaced anteriorly.

The disability was rather characteristic in all types. The arm was held in flexion midway between pronation and supination and both the latter movements were impossible. Pain was markedly increased by abducting the arm and pressing over the head of the radius, and especially so, if pronation and supination were attempted in the above position with the above pressure.

Treatment: In the fifteen cases without displacement the arm was supported by a posterior splint, baking begun on or before the third day, and massage before the second baking, *i.e.*, on the fifth day. Movements in flexion and extension were begun as soon as the swelling subsided, usually about the tenth day. Pronation and supination were begun about the fifteenth day. Result: Flexion and extension were complete in all the cases. In two cases (chipping off of the radial side of the head) pronation and supination were so slightly altered as to be classed as perfect. In eleven cases pronation and supination were half of that on the normal side. In two of the same type as the first two mentioned cases, but with the line of fracture beginning well to the ulnar side of the articular surface of the head and extending outward through the head, supination was one-quarter and

Deformity: The usual angulation, which was most marked in the complete fractures of both bones.

Treatment: Ether anæsthesia, correction of the angulation in the subperiosteal type; in the other types approximation of the ulnar fragments, then traction in ulnar abduction. This traction should be made by two assistants so that the surgeon can manipulate the radial fragments into proper alignment. When the necessary approximation is obtained the arm is straightened, the traction being maintained, and the U-shaped moulded plaster splint⁷ applied, with the arm in the mid-position. The fingers must always be left free.

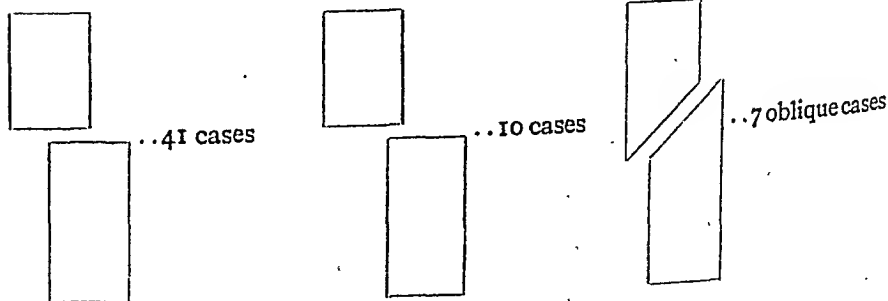
In the transverse fractures one attempt to bring the radius in approximate apposition sufficed in all but one case. In the oblique variety four separate attempts were needed in two cases. The one unsuccessful reduction in the transverse type was ten days old when first observed and could not be reduced. Non-union at the end of eight weeks forced the patient to consent to open operation. The ends of both bones were freshened, sutured with chromic gut, and the U splint applied.

Massage was begun in the second week and the splints were removed as soon as the bones were solid ($4\frac{1}{2}$ to 9 weeks, average 6 weeks). In the operative case, solid union did not occur until the fourteenth week.

Results: In the 33 subperiosteal fractures function was perfect in all cases; 7 cases showed slight bowing of the forearm, as determined by outline drawings with the arm in the mid-position between extension and flexion.

In the cases of complete fracture, function was perfect in all but two cases. In these supination was five-eighths normal and pronation almost complete. Complete perfect end-to-end apposition of the radial fragments was not obtained in any of the cases.

The apposition was as follows (X-ray tracings, schematic):



In the seven oblique cases, there was shortening of the affected forearm of one-sixteenth to one-eighth of an inch and slight bowing on the radial side of the arm. Union in these cases took from two to four weeks longer to become solid than in the transverse type, but occurred in all seven. The function was good in the one operative case, supination was six-eighths normal and pronation almost complete. The arm was one-eighth inch short.

THE CARPAL SCAPHOID.—Fourteen cases were followed; in 7 there was no displacement of the fragments; in 3 the proximal fragment was displaced; and in 4 there was coincident dislocation of the semilunar with displacement of the proximal scaphoid fragment.

The 7 uncomplicated cases were treated by a moulded anterior splint with the hand in slight radial deflection and extension, and the fingers left free. Baking was begun in the first week, massage in the second week, and full movement in the sixth week. Hyperextension was limited in all cases, flexion in one only. In the latter case pain on motion was present during heavy lifting and after long use.

In the three cases with displacement of the proximal fragment, it was removed through a dorsal incision and treated as in the above type. Extension was limited to two-thirds normal and flexion to seven-eighths normal. Ulnar deflection was less on the affected side.

In the four cases with dislocation of the semilunar and displacement of the proximal fragment of the scaphoid, the semilunar and the displaced scaphoid fragment were removed in three cases. In the fourth case the scaphoid fragment was removed and the semilunar replaced. At least it seemed to be reduced at the operation, but the radiograph showed the semilunar still displaced, although not to the same extent as before operation. The result at the end of nine weeks was a stiff wrist. A second operation was refused, and at the end of six months the wrist was still stiff and the patient disappeared. In the first three mentioned cases the result was fair in two. There was some radial deviation of the wrist, the lower end of the ulna was more prominent, flexion and extension were one-half normal. There was some stiffness in the morning and, as explained by one patient, a sense of insecurity after the wrist was used for a time and when heavy lifting was done. No pain existed. One case, the most satisfactory, has already been shown to the society (ANNALS OF

SURG., 1910, vol. lii, p. 261) and in that case there was practically no limitation of motion, and pain only in dorsal extension when lifting unusually heavy weights.

THE FEMUR.—In selecting the cases for observation, fractures of the head, of the neck, and fractures of the neck involving the trochanters have been excluded as those types have been investigated and the end results reported by Whitman,⁸ Walker,⁹ Forbes,¹⁰ Flint,¹¹ and others.

In choosing the cases for observation, the writer has attempted to select cases with a sufficient variety of bone lesions to show the value of any given type of treatment as determined from the end result.

Fifty-three cases have been followed; 2 involved the shaft below the trochanters, 40 involved the shaft, chiefly in the middle third, and 11 were fractures which involved the condyles or the shaft immediately above the condyles.

Two cases of *fracture immediately below the trochanters* (Stafford, New York Hospital, Levinthal, Bellevue Hospital), men, past forty. One was a transverse fracture and the other an oblique fracture about six inches below the posterior lip of the greater trochanter. In both cases the upper fragment was flexed and abducted and there was two inches shortening (measured from the tip of the greater trochanter to the internal malleolus). Both were treated by suspension, traction, and abduction in the Hodgins splint for five weeks, and then by a plaster spica for five weeks longer, at which time union was sufficiently solid to permit the wearing of a long side splint of moulded plaster. Massage and hip moved during the massage. Weight-bearing without support was permitted in the fifteenth week and the knee of the leg as soon as the patient gained confidence enough to walk without support. The time element for this must naturally vary widely. It did in the above two cases. In the oblique case the patient walked alone and unsupported at the end of the seventeenth week. In the transverse case, although muscular power, bony solidity, and freedom of motion in the hip, knee, and ankle were present, the man did not gain enough confidence to walk alone for over two months. He did walk for long distances holding on to the arm of an attendant.

Result at the end of six months: Perfect function in both cases with $\frac{1}{4}$ inch shortening. The case with the transverse fracture

walked with a slight limp, which disappeared when the heel of his shoe was raised $\frac{1}{8}$ of an inch.

Fractures of the Middle Third of the Femur (40 Cases).—In speaking of this region it should be described as the middle two-fourths, as the line of fracture in some of the cases extended either above or below the actual mid-third, although the majority involved that region.

Twenty cases in children from 1 to 8 years of age have been followed. Of these one case, infant 13 months old, had an incomplete fracture of the middle third, one case had a spiral fracture beginning in the lower third and extending upward, the remaining cases were transverse.

The deformity in all except the incomplete fracture was over-riding of the fragments with from one to three inches shortening.

Treatment: Under ether eleven cases were reduced by the traction method described above or a modification of it, and the fragments manipulated until the ends of the bone were made to engage. The leg was then straightened and a plaster spica applied, care being taken to have the anterior superior spine, the mid-patella, and the middle of the ankle in the same alignment as on the normal side. Reduction by this method failed in one case. A long side splint was applied and an X-ray explained the cause of failure. The fracture line began transversely, but about half way through the bone ran upward obliquely, and this long spike on the lower fragment evidently prevented the engaging of the broken ends.

In the ten cases in which the reduction had seemed satisfactory under ether, the X-ray showed a very good reduction with only slight displacement laterally in six cases; two cases showed engagement of the inner and outer sides of the fragments, *i.e.*, lateral displacement; one case showed postero-anterior edges engaged, *i.e.*, anteroposterior displacement; and one case showed over-riding with lateral displacement. A week's delay ensued before a radiograph was taken in the last mentioned case, and a second attempt to correct the deformity on the tenth day failed. A second X-ray two weeks after the injury showed a bony shadow in the region of the periosteal bridge and, as the leg had measured $\frac{1}{4}$ inch shorter than the normal leg, the condition was left uncorrected.

The incomplete fracture was straightened and a plaster spica applied.

Nine cases were treated by vertical suspension of both legs (the case in which primary reduction under ether failed is included). At the end of ten days, measurements and local palpation seemed to show a satisfactory result but the radiograph showed over-riding with lateral displacement in two cases which could not be corrected. In general the radiographs showed the same variety of replacement as in the reductions under ether, with this exception, that the spiral fracture showed some overlapping of the ends although the apposition was good. The extension was removed and a plaster spica applied as above.

The plaster spica was worn for ten weeks in all cases and the children allowed up and about in the twelfth week without support, except in the cases with over-riding in which union was not solid for from two to four weeks longer.

Massage and movement were employed after the plaster was removed.

Result: Six cases showed shortening of from one-eighth to three-eighths of an inch (the spiral fracture, the three cases with over-riding, and two cases treated by vertical suspension); and the most marked shortening occurred in the cases with overlapping of the fragments.

Solid union took place in all the cases with perfect function and no limp. There was no deformity other than the shortening mentioned above, except a slight anteroposterior bowing in the incomplete case and tilting of the pelvis in those cases with shortening. In one case (W., girl, age 5, Dr. Stimson's service, New York Hospital, 1903) treated by vertical suspension for a transverse fracture at the junction of the middle and lower third of the left femur, the note on discharge states that the leg was one-eighth inch short. Seven and one-half years later, Feb., 1911, the child came to the Out-patient Department of the New York Hospital for another condition, and at that time the two legs were of equal length. There was a difference of circumference of five-eighths of an inch four inches above the patella on the left side, *i.e.*, the left thigh was smaller than the right.

The writer has measured two other cases, six and four years after injury, but has found no apparent change in length from that stated at the time of discharge. Whether this discrepancy was due to error in measurement at the time of discharge or due to more growth on the affected side must remain unsolved.

Twenty cases of fracture of the middle two-fourths of the

femur in adults have been followed. The patients ranged in age from 15 to 76 years.

The line of fracture was transverse in ten and oblique in ten cases.

Shortening of the affected leg of from one to four inches was present on admission.

Five cases were treated by the Hodgins splint with additional traction as recommended by Dr. Stimson;¹² four cases were treated by a modification of the incline plane (the thigh piece was inclined while the lower leg piece ran horizontally as in the Zup-pinger¹³ apparatus) with additional traction by a weight pulling in the axis of the inclined thigh; ten cases were treated by Buck's extension on the Volkmann sliding rest with the counter-extension advised by Bardenheuer,¹⁴ and one case was reduced under anæsthesia as soon as seen (*v. infra*).

At the end of from one week to ten days' extension, an X-ray was taken and measurements made. In none of the cases did these investigations show a complete end-to-end reduction of the fracture, but the apposition seemed satisfactory in all except four of the cases. In these four, the over-riding could not be overcome and they were operated upon by methods to be discussed later. Two had been treated by Buck's extension, one by the Hodgins splint, and one on the modified plane. Two were transverse in type and two were oblique fractures.

After three weeks' extension (15 cases), a plaster spica was applied for from four to six weeks and then a long side splint of moulded plaster, and massage, movements, and baking begun. Weight-bearing was permitted in the young adults in the fifteenth week, without support, but a short side splint was worn by the patients past 38 for from three to six weeks longer.

One case, John G. (House of Relief, May, 1911, Dr. F. W. Murray's service) was brought to the hospital while the writer was present. He was immediately anæsthetized and a transverse fracture of the mid-third of the left femur reduced by the traction method mentioned above. The two fragments seemed engaged and an X-ray taken at once showed the bones end to end with a little lateral displacement, as shown by the anterior view (Fig. 9). A plaster spica was then applied and a second set of radiographs made, which showed practically the same position as the first set, *i.e.*, there was no difficulty in maintaining the position obtained. The subsequent treatment was carried out by Dr.

R. T. Wheeler, of Brooklyn, at the patient's home. Dr. Wheeler reports that the patient has perfect function and no shortening.

In all but two of the above 16 cases there was shortening of from one-eighth to five-eighths of an inch. In the two cases without shortening, one was the transverse fracture in the patient John G., described above and the other was a long oblique fracture treated by the Buck's extension, etc.

Function was perfect in all the cases except one. In this last mentioned case a limp existed which disappeared when the heel of the shoe was raised one-half inch (there was five-eighths inch shortening).

Four cases were operated upon in the above list, and the operation in each case was done after the failure of some type of extension.

CASE I.—Julia R., age 50, New York Hospital, 1903, Dr. Hartley's service. Transverse fracture lower third right femur. Buck's extension. No union at the end of 14 weeks. Operation by Dr. Hartley, ends of bone freshened and a freshly prepared thigh bone of a chicken inserted into the medullary canal on both sides, two chromic sutures through drill holes in the bone, plaster spica. X-ray showed bones in perfect apposition. Primary union of wound. Bone solid in 71 days. The chicken bone could be seen in the X-ray picture up to the eighth month when it disappeared. Examination June, 1910: Perfect function, one-half inch shortening and no limp. The heel of the shoe was raised to compensate for the shortening.

CASES II and III.—One transverse, one oblique in anteroposterior direction, were operated upon after ten days' extension for deformity in over-riding. Deformity corrected, two heavy chromic gut sutures through drill holes in the fragments, plaster spica. Primary union of the wound in both cases (both were robust males 25 and 29 years of age). X-ray showed good but not perfect apposition in both cases and the bone was solid in 60 and 69 days respectively. Shortening of one-eighth inch in the transverse case and three-eighths inch in the oblique case. Function was perfect in both cases and the pelvic tilting readily compensated for the difference in leg length.

CASE IV.—R., Bellevue Hospital, Dr. Woolsey's service, 1910. Two inches shortening after traction for two weeks. Eight-screw Lane's plate for fracture at the junction of the middle and lower third of the left femur. Plaster spica with window. Afebrile

temperature for two weeks. On the fourteenth day a little pouting of the wound was found. This was opened and an abscess which contained the colon bacillus and which reached to the bone was emptied. The abscess was freely drained but the patient succumbed 27 days after the operation. The immediate cause of death was œdema of the lungs, due undoubtedly to the patient's inability to overcome the existing infection. The writer believes that the fault lay in his selecting this case for any type of operation, as the patient had a marked alcoholic history, arteriosclerosis, and was a bad operative risk. It would have been wiser to have left well enough alone despite the bad deformity which would have resulted (operation by Dr. Hitzrot).

Fractures of the Lower End of the Femur.—In this type are included only those cases of fracture of the condyles and the shaft immediately above them.

Six cases were fractures just above the condyles. Three were fractures of the internal condyle and one was a fracture of the external condyle with crushing of the articular surface of the external tuberosity of the tibia.

Four of the supracondylar fractures were almost transverse in type, the line of fracture running just above the internal condyle slightly obliquely outward. In one case the shaft penetrated the cancellous bone in the upper portion of the lower fragment.

The deformity was the same in all four cases, *i.e.*, outward displacement of the lower leg and genu valgum.

All were reduced under ether as soon as admitted, and the X-ray after reduction showed a satisfactory result in all except one case (M., Bellevue Hospital, 1909, Dr. Hartwell's service). In the latter open operation was done after a second attempt at reduction had failed, the bone fragments pried into apposition, where they remained without any further fixation.

Moulded plaster in all cases for ten weeks, then massage, baking, motion, etc.

In three cases the function was almost perfect, there being less than 5 degrees loss of flexion. In the operative case the knee was slightly more in the valgus position than on the normal side.

In the case with crushing of the lower fragment (Mrs. B. age 50, New York Hospital, 1909, Dr. Johnson's service), but in which the radiograph shows a perfect reduction, flexion

was limited to a right angle. After long use the knee was also painful.

Two cases were oblique fractures just above the condyles with the obliquity running from the anterior surface below upward and backward. In these there was the characteristic flexion of the lower fragment. Both were treated on the double incline plane with additional traction by adhesive plaster in the long axis of the thigh. In neither case was flexion of the lower fragment completely overcome. Solid union occurred with one-quarter inch shortening and limitation of flexion of from 10 degrees to 20 degrees, the latter being most marked in the case of the older of the two patients (J. B., age 57, Bellevue Hospital, Dr. Gwyer's service, 1907). Slight anteroposterior bowing was evident in the latter case, although the X-ray showed practically the same degree of reduction in both.

The three cases of internal condylar fractures were treated by reduction under ether and circular plaster. In all, the X-ray showed very little displacement, although the line of fracture was quite distinct and the long oblique upper end of the lower fragment could be seen projecting beyond the contour of the bone. Care was taken to have the leg alignment (anterior superior spine, mid-patella and mid-ankle line) the same as in the opposite limb.

Result: Perfect function without any deformity other than slight widening of the condyles in two cases. In one case (a female, Isabella W., Bellevue Hospital, 1908, Dr. Woolsey's service) the lower leg was adducted too much, so that there was less than the normal knock-knee on the affected side, but the function, etc., were as good as in the other cases.

In the case with fracture of the external condyle with a crushing fracture of the external tuberosity of the tibia, there was little displacement of the femoral condyle but marked genu valgum. The limb was adducted as much as possible and put up in plaster.

Result: Genu valgum marked on affected side (the patient originally was slightly bow-legged) with limitation of flexion to a right angle. Later flat-foot developed in the foot on the affected side. An X-ray three weeks after reduction showed a nearly perfect reduction of the fracture of the femoral condyle but marked crushing of the articular facet of the external tuberosity of the tibia.

THE TIBIA AND FIBULA.—Eighty-five cases of fractures of

these two bones were followed; 15 cases were in children under 10 years and 70 cases were in adults between 17 and 60 years.

Types of fracture: In 35 cases the line of fracture was transverse, in 47 it was oblique, in one case it was spiral, and two of the cases were oblique fractures with comminution. In all except two of the cases the line of fracture in the fibula was at a higher level than that in the tibia, and in these two cases it was found at the same level.

No characteristic type of deformity, other than the angulation at the site of the fracture, change in the line of the tibial crest, and shortening of the tibia, was present.

All cases were treated by immediate reduction when seen and an anæsthetic was given for the reduction. Traction was made on the foot and counter-traction by a sheet over the body under the perineum. Then by local manipulation the fragments were brought into alignment, *i.e.*, the subcutaneous line of the tibial crest was brought into alignment. This was most easily done in children and in elderly individuals and with much more difficulty in robust muscular adults. It was also easier to approximate the transverse fractures than the other types. When reduction was accomplished, moulded plaster splints were applied which included the foot, ankle, and knee, first a posterior one and then a long U-shaped splint on each side, leaving the tibial crest free for determining any change in the line of the crest. The results were confirmed by X-ray pictures. At the end of two weeks the splints were so cut that motion in the knee became possible and massage was begun. In the third week baking of the ankle was begun.

In two cases of oblique fracture reduction was not considered satisfactory and a second reduction under anæsthesia was done within the first week. Perfect reduction was obtained in 30 of the transverse cases, and so nearly perfect in 37 oblique cases that one may call it so. In the remaining cases, 4 transverse, 10 oblique, 1 spiral, 2 comminuted, the alignment was good and the approximation sufficiently fair to warrant leaving the reduction.

Result: Delayed union occurred in two cases, one transverse and one oblique, which came under observation one week and ten days respectively after the injury with circular plaster about the unreduced fracture. Under anæsthesia the deformity was corrected as much as possible. Union became solid in one case in

four months (transverse), in the other case (V., New York Hospital, 1905, oblique), in six months. In both cases a leather laced brace was worn after the second month and the patient allowed to use the leg. In both cases slight bowing occurred in the tibia and shortening of three-eighths and one-half inches respectively. Function was perfect in both cases.

Slight lateral angulation at the seat of fracture caused bowing of the tibia with the concavity inward in 12 cases. In 21 cases there was shortening of the tibia from one-sixteenth to one-quarter inch. In two cases a distinct knob remained at the seat of fracture (excessive callus). One case developed flat-foot. Function was perfect in all cases.

The time at which union became solid varied according to the age of the patient, *i.e.*, it occurred most rapidly in children (4 to 5 weeks), in young adults in from 5 to 8 weeks, and in the patients past forty in from 6 to 14 weeks. The two cases of delayed union mentioned above were in men past fifty but are not included in the above statement.

Pott's Fracture.—Sixty-four cases of this lesion were traced after one year from the time of the injury; 54 were in men and 10 in women.

All presented the picture typical of this fracture and all were treated by the method recommended by Stimson (*loc. cit.*). The splints were removed in from 5 to 7 weeks, most frequently at the earlier period. Massage and baking were begun in the second week and movement when the splints were removed.

In interpreting the results, it was necessary to separate those patients over 55 years of age from the others to get a fair idea of the actual end result.

Thirty-eight cases were in individuals under 35 years and all had perfect function, flexion and extension at the ankle-joint practically the same in both legs, and no pain.

Twelve cases were in patients between 35 and 50. Function was perfect in all the cases. Extension was normal, but there was distinct limitation of flexion in all. Two cases had pain, dull, aching in character after prolonged use.

Fourteen cases were in patients between 55 and 64. Function was perfect in four only, five had practically a stiff joint, and the remainder had motion enough to walk satisfactorily on the level but had difficulty on any incline and on steps. Flexion and

extension were limited in all and in five as stated above there was the barest possible motion. All had pain with barometric changes and 9 cases had pain after use.

CONCLUSIONS.

The writer believes that that method of treatment which offers the patient the most satisfactory functional result with the least danger should be the method of election in the treatment of the great majority of simple fractures.

That the future will show, as the cases above have shown, that the method which most nearly fulfils the above requirements is the non-operative reduction of fractures.

That the more experienced the profession becomes in the handling of fractures the better the results will be.

That operation must be considered not the method of election, but the method of selection for a carefully chosen group of cases, and that in selecting the types for operation, each case must be considered a law unto itself.

The writer begs to acknowledge his indebtedness to the attending surgeons of the New York Hospital and the Second Division of Bellevue Hospital for the material from which this study is made.

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- ⁶ Graessner, Stuttgart, 1907.
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- ⁸ Am. Jour. Med. Sc., July, 1905.
- ⁹ ANNALS OF SURGERY, 1908, vol. xlvii, p. 984 *et seq.*
- ¹⁰ Am. Jour. Orthop. Surg., 1909, vol. vi, p. 471.
- ¹¹ ANNALS OF SURG., 1908, vol. xlviii, p. 729.
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- ¹⁴ Bardenheuer u. Graessner: Ergebn. d. Chir. u. Orthopæd., Band 1, 1910 (literature).

LUXATION OF THE ULNA FORWARD AT THE WRIST (WITHOUT FRACTURE).

WITH REPORT OF A CASE.

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AND

W. J. BRICKLEY, M.D.,

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THE case herewith reported is presented, as such cases traditionally are, after a careful search of the available literature for data.

Probably we have missed a case here and there, but after all it is not important whether ours is the twenty-seventh or twenty-eighth.

Luxations of this type are so excessively rare that few men have seen them.

To bring to the attention of the profession a rare lesion that by its very rarity might prove perplexing, to satisfy curiosity as to its mechanism of production, and best of all to point out the method for its easy and efficient treatment—these things are perhaps worth doing.

On April 12, 1911, an Italian of about forty-five, strongly-made but small-boned, was brought into the Haymarket Square Relief Station of the Boston City Hospital.

Dr. Brickley, the surgeon on duty, recognized the lesion presented and its rarity, and called me up as a matter of interest.

When we examined the case together the condition shown in the sketches was conspicuous—a loss in the breadth of the wrist, an increase in depth (not conspicuous, however), and a very curious outline of the wrist seen from the back and from

the outer side. There was some limitation of motion; the hand was held in semipronation.

The detailed tests were in some degree less easy because the man spoke little English and was rather full of liquor.

The history (gotten then, confirmed next day) was that he was engaged in unloading beer-kegs from a wagon on to a platform that stood at about the height of his shoulder or a bit higher; he was pushing on a keg when it slipped or proved too much for his strength. Hand and radius were displaced suddenly backward from the muscularly fixed ulna. The hand and radius were dislocated backward by the sheer tearing of ligaments under force. In the usual phrase, the *ulna* was dislocated *forward* and slightly inward, so that it overlapped the radius a little in front. A glance at the sketches shows the character of the deformity better than it can be put into words (Fig. 1).

After the patient was anæsthetized, Dr. Brickley attempted reduction by traction combined with direct pressure on the displaced ulnar head. On suggestion he combined with these manœuvres a sharp pronation of the arm, and the bone slipped into its appointed place with a click. All motions became free and all deformity disappeared; splints were applied.

Next day the patient was sent to the "Main" City Hospital and there an X-ray plate was taken, a print from which is here reproduced (Fig. 2). There was no sign of any associated fracture. It has been impossible to trace this patient more recently, and our belief in a good resulting function is one of inference only.

This lesion—uncomplicated forward luxation of the ulna at the wrist—seems first to have been described in any adequate fashion in an article published one hundred and twenty years ago in the "Journal de Chirurgie par P. Desault" for the year 1791. This is in volume i, No. 1, page 78, and is but an extract of an unpublished talk by Desault delivered before the "Academie de Chirurgie" in the year 1777.

The case involved was a cadaver case, without history, but was undoubtedly a case of forward luxation of the ulna alone, without fracture.

Dupuytren saw and reported a couple of cases in his book published in 1834.

Malgaigne, later, collected a series of these cases, in his "Fractures and Luxations," which appeared in 1855.

Many years after, in 1874, Tillmanns¹ again worked up the subject and collected all records of ulnar luxations at the wrist, of which a minority were luxations of the ulna forward of the type with which the present paper is concerned. A more recent collection is by Baum, published in 1902.

Not all of these cases will pass, for in a number of them no account is taken of the question of associated Colles's fracture. Every working surgeon knows that forward subluxation of the ulna, or rarely total luxation, is an almost constant concomitant of this fracture, provided there has been any considerable displacement.

For our present purpose only the cases of *independent* luxation of the ulna forward are of interest.

It would not be fair to admit only those cases in which the X-ray shows no associated radial lesion, for many of the ancient reports bear evidence of very careful observation; yet it is fair to consider only such cases of to-day as have been so tested, to sift the cases of earlier years, and to admit only those that *seem* to belong to the class of forward luxations of the ulna at the wrist, *without* associated radial lesions.

The list later given is an attempt to sift these cases, and includes all cases we have been able to find that pass the test.

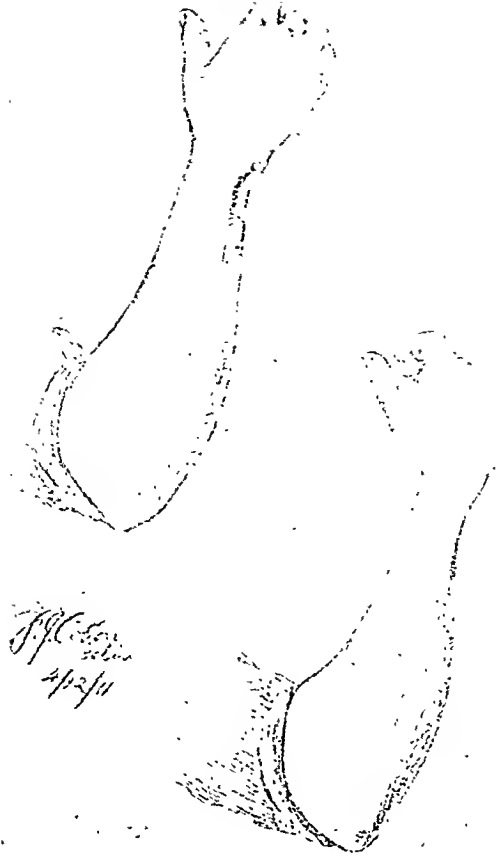
The lesion being rare has been the more carefully studied for that reason—a paradox familiar to every one who reads surgical literature; and there are as usual several theories of mechanism on record, and projected and applied reductions in plenty.

The facts seem to be as follows:

The lesion is rare; it occurs only as the result of much force, applied suddenly or slowly.

There seems to be two mechanisms at least: (a) forced

¹ Tillmanns: Archiv. f. Heilkunde, 1874, p. 249.



Sketches of the wrist before reduction—from the back and from the radial side. Note the narrowness of the wrist and the sharp edge of the radius next the hollow left by the ulna.

FIG. 2.



Skiagraph taken after reduction of the dislocation. There is no fracture



supination (Cases 7, 8, 11, 12, 16, 20, 25); (b) direct backward shove on the hand with the ulna fixed by mechanical impediment (Case 15) or by the force of the triceps (Cases 3, 21, and our case).

The other mechanisms apparently different are probably reducible to one or another of these.

The lesion is a tearing loose of the lower end of the ulna from most or all of its ligaments, and its displacement forward. Rarely it goes only forward; in most cases there is clearly described the displacement outward so that the ulnar head somewhat overlaps the radius seen from the front, as in our case, coming to lie under the common flexor tendon group, deeply buried.

Pronation is lost; flexion, extension, and finger motion are only moderately interfered with.

The amount of hæmatoma and swelling, of pain and disability need not be very great.

The diagnosis is simple. The wrist is curiously narrow (see Fig. 1).

The normal prominence of the ulnar head at the back of the wrist is gone, and in its place is a hollow beginning above in a gradual slope, bounded at the side by the sharp edge of the radius, below by the rather abrupt edge of the now prominent cuneiform. The ulnar head is not nearly as obvious in front as one would expect; it is of course covered by the flexor tendons, but even at that the anteroposterior diameter of the wrist is not conspicuously increased.

Reduction in these cases is more difficult than one would expect. Dupuytren had good luck with direct pressure backward on the head (cf. Cases 2 and 3).

Boyer devised an elaborate scheme of reduction by shoving thumb and fingers between the bones front and back—a sort of *distraction* reduction. This worked fairly well (cf. Cases 7, 6, etc.).

Best of all perhaps is a combination of moderate traction with direct pressure backward on the ulnar head, *accompanied by forced pronation*.

This solved the trouble in our case, as it did in most of the listed cases.

The *form* of after-treatment is not of first importance. In only two cases (Cases 17, 24) was there any tendency to recurrence of the luxation.

Repair is prompt; in the vigorous young men of the series a fortnight was enough for apparently serviceable recovery, though no doubt another week or two of care would be wise.

The end results, in cases in which recognition and reduction of the lesion have not been unduly delayed, have been admirably good, practically always perfect.

LIST OF RECORDED CASES.

(The list is roughly chronological; the numbers are the reference numbers used in the text.)

1. DESAULT: Cadaver case; typical luxation; no history (*Journal de Chirurgie*, vol. i, No. 1, p. 78).

2. DUPUYTREN: Soldier of 32 years of age; fell with his horse. Type luxation; reduced by direct pressure.

3. DUPUYTREN: A builder thrust violently with his hand against a wall that threatened to fall, and so dislocated the ulna forward at the wrist. Reduction as in Case 2. (Dupuytren, *Lecons orales de Clinique Chirurgicale*, 1834, vol. iv, pp. 503 ff.)

4. PALLETTA: A slightly doubtful case; cadaver specimen; subluxation only (quoted in detail by Rognetta, *Archives gén. de Méd.*, 1834, ii S., Tome v, p. 405).

5. VALLETEAU (reported by Espiaud): Boy of 13, who had his wrist twisted in a moving wheel, received a *compound* forward luxation of the ulna. This was reduced and gave, in the end, excellent function.

6. VALLETEAU (reported by Espiaud): Cannoneer, thrown, and had wrist run over. Reduced by "Boyer's method," but without pronation. (Cases 5 and 6 were reported by Espiaud for Valleteau, *Gaz. Méd. de Paris*, 1836, ii S., Tome iv, p. 250).

7. BOYER: Luxation by forced supination of the wrist (wrist-twisting in a "scrap") in an elderly woman. Reduced by "Boyer's method," combining sharp pronation with the distraction manœuvre (quoted by Malgaigne, *Traité d. Fractures et d. Luxations*, 1855, vol. ii, p. 687).

8. GODELIER: Luxation by rolling of a heavy weight on to the fixed and supinated wrist. Reduced by abduction and pronation (quoted by Malgaigne, *loc. citat.*).

9. MALLE: Fall on the supinated arm. Reduced by "Boyer's method."

10. MALLE: Reduced according to Boyer (quoted by Malgaigne,

loc. citat., without details, with reference only to an inaccessible old military journal).

11. PARKER, of Liverpool: Man of 40, had his wrist pinned down by the shaft of a cart. The hand was supinated, and pronation was lost. Head of ulna under flexor tendons. Reduced by forcible pronation with direct pressure (quoted by Hamilton, "Fractures and Dislocations," 3d. ed., p. 117).

12. DUCHAUSSOY: Carpenter, 28 years old, caught in machine, in supination; reduced by abduction and flexion. Pronation and supination remained somewhat limited (*L'Union Médicale*, 1855, Tome ix, p. 575).

13. PURDOM (quoted as Purdon by Baum): Hand and arm caught between rollers of a planer (obliquely). Typical lesion, reduced by traction and pressure (*Edinburg Medical Journal*, 1874, xx, p. 325).

14. OHLEMAN: Man of 42; arm pinned between body of horse and crib. Hand thenceforth useless. Deformity typical. Reduction by traction and direct shove on the ulnar head. Perfect result (*Archiv. f. klin. Chirurgie*, 1875, xviii, p. 423).

15. R. F. WEIR: Woman of 48; hand and forearm caught in a dumbwaiter in supination. Type deformity. Reduction by direct thrust. Power to pronate returned promptly. Result perfect (*Hospital Gazette and Archives of Clinical Surgery*, New York, 1877, vol ii, p. 10).

16. STIERLIN: Man of 66; was putting on a belt (on shafting) when his hand was caught in supination. Type deformity. Reduction by pressure (*Correspondenz Blatt f. Schweiz. Aerzte.*, xix, 1889, S. 684).

17. BRIGGS: Woman of 72; fell with her wrist caught and jammed. Type deformity. Reduction by traction and direct pressure. Partial recurrence at 8 days; re-reduction. Final result excellent (*N. Y. Medical Record*, May 9, 1891, p. 553).

18. WEIZ: Quoted by Baum without a reference.

19. JONES: Male of 35. Was struck by the "kick" of a machine in the palm—given as over pronation (?). Type deformity with lost rotation, etc. Reduced by extension and *supination* (*Lancet*, 1893, i, p. 862).

20. WHITE: Hand caught in a belt. Type deformity. Reduced (under chloroform) by traction and direct pressure (*British Medical Journal*, 1893, i, p. 641).

21. KIRKBY-THOMAS: On board ship a man had his wrist struck by a heavy swinging loading hook. Typical deformity. Reduction by pressure and pronation (*British Med. Journal*, 1896, ii, 1774).

22. LEISTENDORFER: Soldier, hand slipped in exercise-vaulting and he fell over it. Type luxation. Reduced by abduction and pronation. Rapid and permanent recovery (*Deutsche Militär-ärztliche Ztschr.*, Berlin, 1896, xxi, S. 333).

23. BAUM: Male of 44 years; arm struck by a stone. Type luxation except that the ulnar styloid was broken (*Deutsche Ztschr. f. Chirurgie*, Bd. 67, 1902, S. 645).

24. VALLAS: Patient struck the ulnar side of the arm on a rail in falling. Typical displacement. Reduction by pronation, recurrence on

supination. Was again reduced by pronation. Some ulnar nerve tingling after this manipulation (*Lyon Méd.*, 1904, Tome 103, p. 885).

25. THON: Male of 50, had hold of a rope running over a limb. This hand was dragged over by the running rope in forced supination. Reduction by traction and pronation (*Deutsche Ztschr. f. Chirurgie*, lxxxiv, 1906, S. 257).

26. HAEDKE: Woman of 63, wrist twisted in a quarrel; thought to have been pronated. Typical volar luxation of ulna (*Deutsche Ztschr. f. Chirurgie*, 1907, vol. xci, p. 429).

27. HILL: Male, age 52 years, while cranking his automobile the motor back-fired, throwing his hand in violent supination, causing a rupture of the internal lateral ligament and anterior ligaments, and tearing the triangular interarticular fibrocartilage, resulting in a forward displacement of the head of the ulna where it could be felt under the flexor tendons with a very perceptible corresponding backward depression. The patient, when seen shortly after the accident, was suffering greatly. The pain was not materially increased by flexion and extension, but pronation and supination added greatly to his discomfort. Flexion of the forearm and pressing the head toward the sigmoid cavity of the radius during extension and counter-extension made reduction easy, but the application of splints for five weeks did not prevent redisplacement to some extent. Patient still complains of weakness especially in pronating. There was no clinical manifestation of fracture of the radius nor did an X-ray picture show the slightest sign of one anywhere. (Personal communication from Dr. L. L. Hill, of Montgomery, Ala.)

OSTEOMYELITIS OF THE LONG BONES.*

A STUDY OF NINETY-FOUR CASES FROM THE CHILDREN'S HOSPITAL, BOSTON.

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THE series of cases upon which this paper is based includes all those which have been treated at the Children's Hospital since the publication in 1904 of Nichols's¹ classic monograph, which placed the pathology and treatment of osteomyelitis upon a sound and enduring basis. A study of these recent cases, though it brings out nothing essentially new, emphasizes some tendencies of the disease which are certainly worth recording.

It is not my purpose to cover by a mass of statistics every side of this subject, but to illustrate the manner in which infection seeks out and works upon the different bones, the variations in the course and virulence of the disease, the value of the Röntgen ray in diagnosis and treatment, and, finally, the results of the treatment itself.

Localization.—In going over a long series of cases, it has been a very striking observation that the first evidence of disease has appeared at one end or the other of the infected bone. In other words, the history has generally shown that it was not the thigh, leg, arm, or forearm, which first became painful, swollen, and tender, but the hip, knee, ankle, shoulder, elbow, or wrist. In most of the instances in which the history has failed to give evidence upon this point, the Röntgen plates have supplied the lack by identifying the original focus of infection. In a few cases the disease has been so rapidly fatal that the primary focus has been impossible of identification, and in about an equal number, the infection has evidently invaded the shaft from the periosteum at a distance from a joint.

* Read before the Boston Orthopædic Club, November 13, 1911.

Several years ago Stone² called attention to the fact that many infections of the long bones, which occur in or near the epiphyseal line, break out from the bone at that point, and may then produce an extensive abscess beneath the periosteum of the diaphysis with but slight involvement of the medullary cavity. While a study of this series does not show this to be a common occurrence, it does indicate that the primary focus is nearly always to be found in the end of the diaphysis, and that it frequently remains local or breaks out from the bone through the epiphyseal line without spreading far into the medulla of the shaft.

I submit the following figures to illustrate this point. Among 94 patients, the number of bones infected (excluding the lower jaw and the small bones) was 113. Of these 113, there is evidence in the history or Röntgen plates (or both) that in 95 the primary focus appeared in one or the other end of the diaphysis. To answer the possible objection that the neighborhood of the joint appears to be the original seat of disease only because the inflammatory products find their way to the surface most easily at this point, I will say that in no instance does the Röntgen plate contradict the history as to the position of the original focus, and moreover, as will be shown later, the study of a series of plates taken in the early stages of an extensive disease of any bone will generally disclose the original focus.

This same line of investigation gives evidence rather at variance with the findings of Le Conte,³ recently published, with regard to the periosteal origin of infections of the medulla. Le Conte gives the impression that he considers the penetration of an osteoperiostitis into the medullary cavity a common occurrence. In the Children's Hospital series, this condition is the exception. In only eight bones out of 113 can this process be definitely shown to have occurred, though in the Röntgen plates the appearance of such a lesion is in marked contrast to the usual process originating in the epiphyseal end of the diaphysis (Figs. 1 and 2). In the rare instances, however, of an isolated process situated in the medulla

at some distance from one end, it is difficult to say whether the infection penetrated from the outside or not. Of such cases there are four in this series, and in six others there is no evidence whatever as to the position of the primary focus.

I think it may then be assumed that the great bulk of the infections are medullary in origin, and that their primary focus, certainly their earliest manifestation, is found near the epiphyseal line. With this in mind I have attempted to discover whether any particular bones show a preponderance of infections over others, or at one end over another. The following list records the result of this investigation:

Femur, upper end 24, lower end 15 (and one general infection of unknown origin).

Tibia, upper end 12, lower end 19 (and three general infections of unknown origin).

Fibula, upper end 3, lower end 4.

Humerus, upper end 9, lower end 0.

Radius, upper end 0, lower end 4 (and two general infections of unknown origin).

Ulna, upper end 1, lower end 1.

Clavicle, inner end 2.

This list speaks for itself. Disease of the bones of the leg is easily more common than that of the arm. Disease of the femur is somewhat more common than of the tibia, its nearest rival, and of all the regions affected the upper end of the femur presents the most numerous infections. The preponderance of infections of the bones of the leg makes it appear as if the wear and tear of locomotion were accountable for this selection. How far an actual blow or fall is the actual exciting cause, is not clear from the histories. It is generally mentioned, but when one considers the innumerable bruises of childhood it is not strange that some violence can be remembered to have preceded the disease.

Apparently, then, there is good reason to believe that there is something peculiarly open to attack in the region of the epiphyseal lines of the long bones. More than that, the ends of the bones supporting the body are more frequently affected than those of the upper extremity. Possibly the character of the blood supply of the growing part of the bone renders

this point particularly vulnerable. Whatever the cause, it is interesting to study the course of these infections according to the anatomical relation of the various epiphyses to the different bones, for if the disease can more easily break out into the soft parts in one region than another, or if perhaps one end of a shaft offers a better structural resistance than another to the spread of infection, we should expect to find variations in the frequency with which each bone becomes completely invaded. There might, indeed, be variations according to age, but as all the children in this series are under twelve and rarely over ten, the differences in the degree of union of the epiphysis with the shaft would probably be negligible.

The following table records the number of infections originating at either end of each long bone, the number of general infections resulting, the percentage of general infections to the total number of infections in each locality and in each bone, the number of general infections of unknown origin, and the number of cases of local disease in the middle shaft. The term general infection refers to a condition in which at least two-thirds of the shaft becomes necrotic.

Origin of infection at upper end	Gen'l infections resulting	Gen'l infections to total No. of infections of upper end	Origin of infection at lower end	Gen'l infections resulting	Gen'l infections to total No. of infections of lower end	Gen'l infections of unknown origin	Mid-shaft infections	Gen'l infections to total No. of infections
Femur..... 24*	3	Pct. 12.5	15	4	Pct. 26.6	1	1	Pct. 20
Tibia..... 12	5	41.6	19	5	26.3	3	7	34.2
Fibula..... 3	3	100	4	0	0	0	2	33.3
Humerus..... 9	3	33.3	0	0	0	0	2	27.3
Radius..... 0	0	0	4	4	100	0	0	100
Ulna..... 1	1	100	1	1	100	0	1	66.6
Clavicle (inner end)..... 2	1	50	..	..	....	0	0	50

* A number of infections classified in the records as osteomyelitis of this region have been excluded though abscesses in the soft parts appeared to lead to bone, either because of a lack of absolute proof of bony involvement, or on account of a possible tuberculous origin.

Perhaps these tables offer too few cases for safe generalization, and possibly the means of identifying a certain portion of the bone as the seat of the primary focus are inadequate, but even if these objections are valid, and I think they are not, the conception of osteomyelitis as a disease originating in or near the epiphyseal line is at least strongly suggested. The upper end of the femur is easily the most common seat of the primary focus, and furnishes as well the lowest percentage of general infections. Taken as a whole, the femur shows a smaller proportion of general disease than any other bone, though its lower end does not differ in this respect from the lower end of the tibia. Examination of the Röntgen plates and operative findings leads to the observation that disease of the upper part of the shaft originates commonly beneath the great trochanter, the head, and the lesser trochanter, the three epiphyses of this region. That such foci should break out to the surface without dissecting up the neighboring periosteum is not strange when we remember the powerful character of the muscular attachment about the upper end of the bone. The failure of the general shaft to become involved is apparently due to the ease with which the inflammatory products can escape from beneath the epiphyses as well as to the solidity of the structure of the upper part of the shaft. The Röntgenographs which illustrate this localized hip infection (Figs. 3, 4 and 5) are taken, in part, from an excellent study of this subject by Legg and George.⁴

This peculiarity of the femur is all the more remarkable in view of the fact that in both the tibia and fibula general infections more often start from above than below, a tendency which we might perhaps expect as an effect of gravity on drainage. In this respect the humerus can perhaps be placed in the same class with the tibia and fibula, though as there are in this series no records of disease of the lower end, the comparison is not quite fair. This freedom on the part of the end of the humerus which enters into the elbow-joint seems rather extraordinary, considering that the elbow is pretty severely battered in childhood. It indicates, perhaps, that blows and falls are not a very potent influence.

In the smaller bones general infections are the rule, though the total number of cases is small. There are no striking peculiarities among these bones, except that the upper end of the radius shares with the lower end of the humerus a complete freedom from disease.

Variations in the Course and Virulence of Osteomyelitis.—

The variations in the course and severity of the disease are well illustrated in this series. In some instances a mild attack has never required operation, and the only evidence of its passage has been a slight alteration in the bone, as shown by the Röntgen ray. In others the onset has extended over months and the cure required a very minor operation. In such cases the diagnosis of rheumatism or tuberculosis is often made. In most instances the onset has been sudden and violent, and the full extent of the destruction of bone has taken place in a few days to two weeks. In the less virulent of these typical infections, the breaking out of the process from the epiphyseal line has saved the medulla from complete destruction, in much the same way that it is saved by operation, but in the most rapid, the child has died of toxæmia before local evidence of trouble was fully apparent.

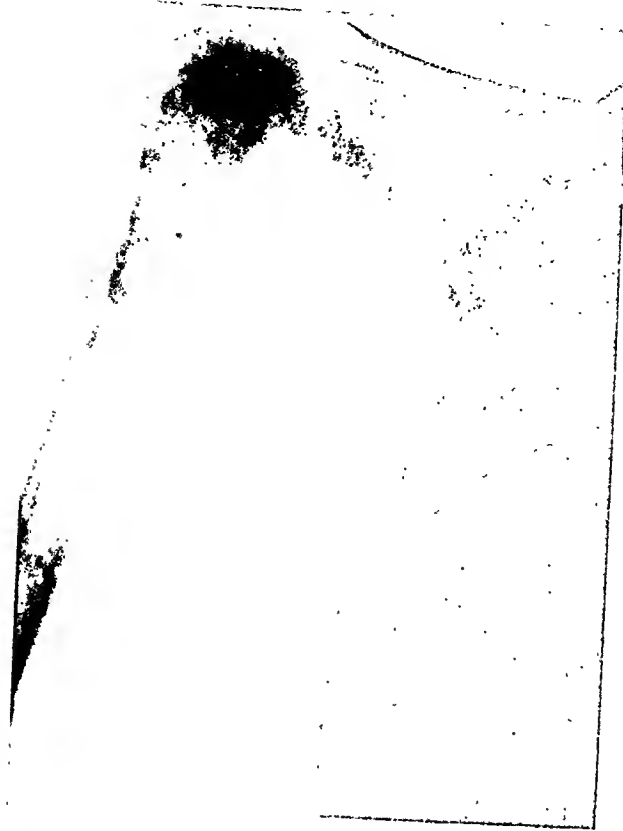
Use of the Röntgen Rays in Diagnosis and Treatment.—

While there is no one more valuable aid in the diagnosis and treatment of osteomyelitis than Röntgen plates, the use of this aid is subject to one most important limitation, which has frequently been illustrated at the Children's Hospital. It appears to be a fact that, according to the greater or less rapid destruction of bone in any one case, the Röntgen plate may lag more or less behind in revealing the full amount of damage. Not enough is known, perhaps, of Röntgen ray pathology, so to speak, to say just how soon after a portion of bone has become cut off from its blood supply it will cast an altered shadow upon the plate. And again, a fair plate may not even suggest what a perfect plate will clearly show. Under the circumstances, it is perhaps fair to say that positive evidence in plates taken during the first few days of an acute disease is most important in establishing a diagnosis and localizing the

FIG. 5.

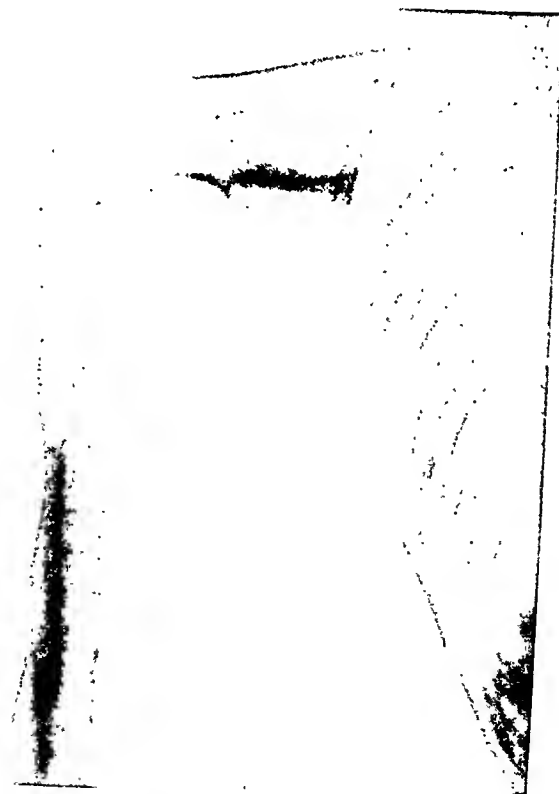


Osteomyelitis of the femur. Origin in the region of the great trochanter. Plate taken five months after onset.

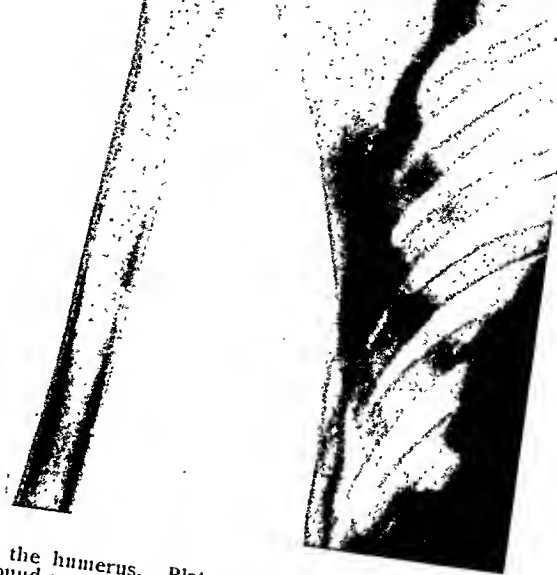


Same case as Figs. 8 and 9. Plate taken eight weeks after onset. Notice regeneration of bone at site of operation and the density and extent of the new periosteal bone.

FIG. 11.



Same case as Figs. 8, 9, and 10. Plate taken seven months after onset. Arm had been healed for three months. Notice welding of periosteal new bone with the shaft.

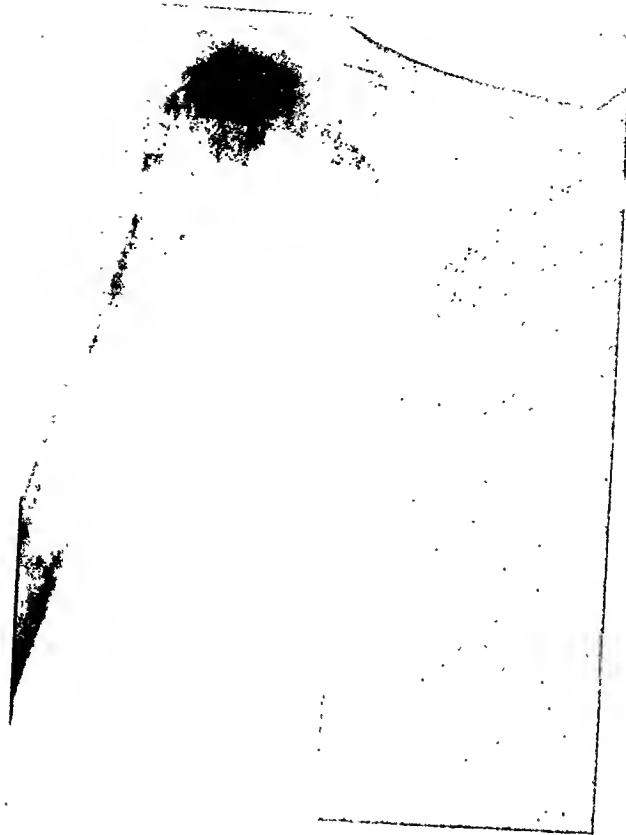


Osteomyelitis of the humerus. Plate taken Feb. 17, 1911, six days after onset. At this time there was found an extensive abscess beneath the deltoid, pus under the periosteum for three inches downward from the epiphyseal line, and pus in the upper end of the medulla of the shaft extending downward from the epiphyseal line for about an inch. Notice the faintness of the indications of bone disease.

FIG. 9.

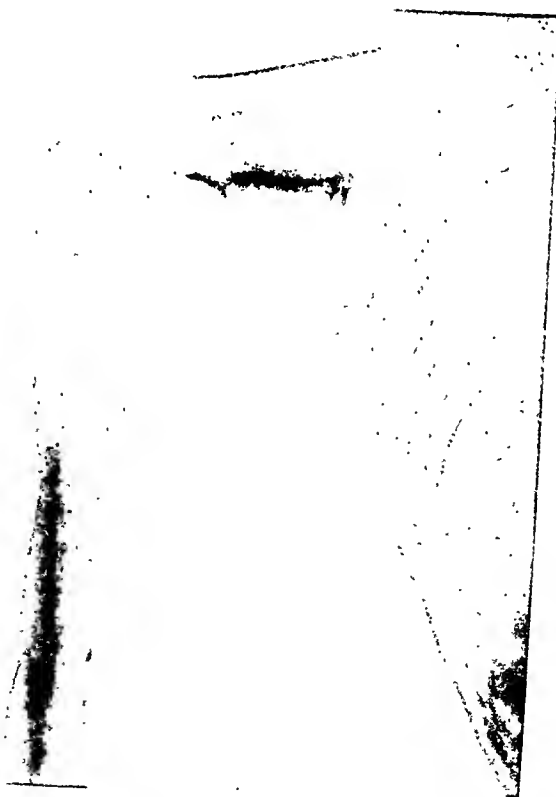


Same case as Fig. 8. Plate taken March 7, 1911, 24 days after onset. The bone has been widely opened to just below the lowest piece of metal shown in the print. Notice the irregular small areas of suppuration below this point and the extent of the periosteal thickening.



Same case as Figs. 8 and 9. Plate taken eight weeks after onset. Notice regeneration of bone at site of operation and the density and extent of the new periosteal bone.

FIG. 11.



Same case as Figs. 8, 9, and 10. Plate taken seven months after onset. Arm had been healed for three months. Notice welding of periosteal new bone with the shaft.

Osteomyelitis of tibia. Plate taken Feb. 8, 1911, ten days after onset. Notice outline of necrotic bone in upper one and a half inches of the shaft next the epiphysis.

FIG. 13.



FIG. 14.



Same case as Fig. 12. Plate taken March 11, 1911, seven weeks after onset. Notice regeneration of bone at site of operation, and extent of periosteal thickening.

Same case as Figs. 12 and 13. Plate taken seven months after onset. The leg has been healed for several months. Notice disappearance of the thickened periosteum.

process, but that negative findings under these circumstances should not be taken seriously, nor positive as indicating the full extent of the lesion.

Fig. 8 shows the upper end of the humerus in a boy of eleven years, who had suffered from severe local symptoms for six days before entrance. There is in the plate but very slight evidence of disease, and yet operation performed at once disclosed an abscess in the upper end of the shaft, extending down for an inch below the epiphyseal line, and pus under the periosteum for two inches farther down. Fig. 9 is a later plate of the same case, and shows that the medulla below the obvious pus cavity in the bone, which appeared normal in the first plate and at operation, was the seat of a less active process which only became visible considerably later.

On the other hand, in locating a well-established focus and in following the changes in the bone once the disease has ceased to advance, the Röntgen plate is absolutely invaluable. It directs the operator to the exact focus (Fig. 6); it advises him of the extent of the necrotic bone (Fig. 4); and it enables him to follow the development of the periosteal new bone, so that he may time his secondary operation correctly, and remove as much necrotic shaft as is necessary at the time when the involucrum is ready to grow into its place (Fig. 7).

Treatment.—Inasmuch as the 94 patients in this series have been treated by a considerable number of surgeons, the treatment has been too varied to be effectively summarized. On the whole, conservatism has been the rule, and the results, so far as I have been able to obtain them, seem to be good (see table). There are in all twelve total resections, and by this I mean a resection of the entire thickness of the shaft for at least two-thirds the length of the diaphysis. These I have divided into three classes: first, those performed immediately after the onset of the disease, before the periosteum has had an opportunity to thicken; second, those performed at the time of election some weeks after the beginning of the infection, according to Nichols's dictum, the periosteum being sewed together and made into a collapsed tube; and last, those

performed as in the second class, with the difference that the wound has been packed wide open.

In the first class are two cases:

(1) W. B. Right tibia. Acute onset. General swelling of leg with cellulitis. Subperiosteal resection six days after onset. Periosteum sutured. Result, incomplete regeneration requiring transplantation of fibula. (2) E. C. Left fibula. Acute onset. Cellulitis. Subperiosteal resection three days after onset. Periosteum partly sewed up and the cavity drained with a rubber tube. Regeneration complete.

There are unfortunately too few of these cases from which to draw conclusions. As far as it goes the evidence is against early resection.

In the second class are four cases:

(1) I. S. Left clavicle. Subacute onset. No operation performed for five weeks after onset, when the whole diaphysis was resected subperiosteally and the periosteum sewed up without drainage. Result, complete regeneration. (2) M. D. Osteomyelitis (possibly syphilitic) of right radius. Subacute onset. Subperiosteal resection of most of shaft five weeks after onset. Periosteum sewed up. Result, regeneration after some delay and a minor operation. (3) G. W. Left ulna. Acute onset. Subperiosteal resection six weeks after onset. Periosteum sewed up. Complete rapid regeneration. (4) L. U. Right tibia. Acute onset. Subperiosteal resection seven weeks after onset. Periosteum closed and drain placed at both ends. Complete regeneration in thirty days.

These cases, in which the septic process had died out by the time of the secondary operation, were treated in practically the same way, and in three, excellent results were obtained. The fourth, which was probably syphilitic, did very well while she was followed, but has since been lost to sight.

In the third class are five cases:

(1) D. B. Left ulna. Acute attack. Subperiosteal resection five weeks after onset, the bone being removed in fragments and the wound packed wide open with gauze. Regeneration complete. (2) E. D. Left tibia. Acute onset. Subperiosteal resection nine weeks after onset. Wound lined with rubber

tissue and left wide open. Regeneration complete. (3) A. K. Right fibula. Acute onset. Subperiosteal resection seven weeks after onset. Periosteum closed in central part but cavity drained with iodoform gauze. Wound later required irrigation. Result, partial regeneration. Perfect function. (4) A. M. T. Right tibia. Acute onset. Seven months after onset thick involucrum opened and necrotic shaft removed. Packed with gauze. Result, regeneration with poor cosmetic result. Right humerus. Acute onset. Seven and one-half months after onset thick involucrum opened and necrotic shaft removed. Packed with gauze. Result, regeneration. (5) J. McC. Right fibula. Acute onset. Three months after onset thick periosteum opened and bone removed in fragments. Cavity lined with rubber dam. Result, unknown (patient cannot be traced).

These cases, of the same character as the last, show one failure, but the total number is too small from which to draw conclusions. As far as the results go they speak against packing the periosteal shell with gauze.

I have purposely refrained from discussing at any length the refinements of treatment in complete subperiosteal resection, because I have been unable to see that the results differ very essentially whichever method is used, though, for reasons which will appear later, I cannot believe that any real advantage of the immediate resection outweighs its danger of failure. This brings me to the matter which seems to me far more important than the resection of totally necrotic bone, a step which, like amputation, is, in a way, a confession of failure. I allude to the treatment of the cases in which the disease has remained local, or in which it has not yet infected the entire medullary cavity. Here the primary operation, the one performed when the surgeon first sees the patient, is of the greatest importance, for it is upon this that the excellence of the ultimate result really depends.

The early or primary operation has for its object the saving of life and the limitation of the septic process, two requisites which go hand in hand. In this series there has been an immediate mortality of 7.36 per cent. or 7 cases out of 94.

It is significant that in five of these cases the infected bone was not opened. In another, the bone was opened, and in the last, the history is deficient.

The importance of draining the infected medulla has been too long recognized to require emphasis, and no one ought to hesitate to remove a portion of the cortex, even in the presence of an extensive periostitis, when infection within the bone is in the least suspected. It is in the direction of where and how to drain the bone that this series seems to me to indicate the way, for it has been noticeable that when a painstaking effort has been made to find the original focus and to follow the pus until sound tissues are reached, a secondary operation has been practically unnecessary or minor in character. The principle that the disease almost always starts next to the epiphysis is, therefore, of tremendous importance. The fact that the Röntgen ray will not always indicate the full extent of a process less than a week old is hardly less to be considered. Finally the point made by Nichols, that the endosteum should not be destroyed by reckless curetting, is a third and obvious consideration. The results of treatment carried out on these lines in early acute cases will justify the statement that if the diagnosis is in any way prompt, the actual removal of much of the shaft is a confession of failure. I shall quote from two histories in some detail to illustrate these points. In neither is the treatment free from minor mistakes.

CASE I.—C. F., male, age eleven years. Previous history negative. Entered hospital February 17, 1911. Had an attack of "grippe" for three days, two weeks before. Rather poorly until six days before, when he had pain in left shoulder. Shoulder swelled. Diagnosis rheumatism. Physical examination: local heat, swelling, and œdema, in front of left shoulder-joint and a little way down front of arm. Temperature 105.2°. Aspirated and pus obtained. Röntgen plate shows questionable lesion near epiphyseal line (Fig. 8). Operation at once. Deltoid incised about an inch inside bicipital groove. Abscess beneath deltoid. Periosteum tense and fluctuant. Abscess beneath it from bicipital groove outside to back of arm, and for three inches

down the shaft. Rough friable bone next to epiphysis on inner posterior surface. Opening one inch square, made with gouge, disclosed abscess in bone with most of pus welling up from behind. Enough of medullary structure curetted out to allow free drainage. Narrow slit chiselled downward for about one inch more, showed healthy looking cortex and medulla. Gauze drainage. *Staphylococcus aureus* in culture. Temperature fell to 100.4° in two days and then rose again.

Feb. 22, five days after operation, opening made in back of shoulder-joint and cloudy fluid escaped. Joint drained with rubber tissue. At same time the opening in inner side of the humerus was rongeuired out to the extent shown in the Röntgen plate (Fig. 9). Did well and was healed May 1. On March 11 an infection of the right hip was drained and subsequently healed without complication. No bone involved. On May 14, about three months after original operation, sinus opened of itself at the upper end of the wound in the arm. May 19, secondary operation. Old scar in front of shoulder excised. Involucrum covered old opening in the bone as did a second layer of bone beneath it (evidently from the endosteum, which was as little disturbed in the first operation as possible). (See Röntgenograph taken April 6, Fig. 10.) A clean hole about the dimension of the original was rongeuired out and some spicules of dead bone removed. After this, healing was uneventful. Seen in September when the arm had been healed for several months. No disability. Upper part of the bone thick and irregular. Röntgen plate shows that the periosteum which had grown new bone over practically the entire shaft was welding with it (Fig. 11).

This case illustrates the common mistaking of osteomyelitis for rheumatism, the partial failure of the Röntgen ray to demonstrate a lesion six days old, the location of the infection near the epiphyseal line, the free opening of the bone (not far enough at the first operation as it turned out), and the subsidence of the rather general bone infection, as shown by the Röntgen plates, after drainage. The result is not ideal, but shows the possibilities of regeneration of bone, which at first sight appeared necrotic, through the avoidance of unnecessary injury.

CASE II.—R. H., male, age five years. Past history negative. Entered hospital February 8, 1911. Ten days before entrance

had had a sore throat. Said to have struck right leg against a tree and had complained of pain in lower leg. Swelling of upper right leg just below knee first noticed five days before entrance. Local heat and swelling below right knee extending several inches down the leg. Temperature 102°. Röntgen plate shows disease in upper shaft (Fig. 12). Operation at once. Incision for three inches over inner surface of tibia just below knee. Pus under periosteum and coming from posterior surface. Through a second incision in front of the fibula the posterior and outer surfaces were curetted off downward from the epiphyseal line for one and one-half inches. Cigarette drain. Streptococcus in culture. Good recovery. Successive Röntgen plates show extensive periosteal reaction and rarefying of bone for upper three inches (Fig. 13). April 5, two months after first operation, a small fragment of dead bone was removed and healing from then on was uneventful. Final condition shown in Fig. 14 (plate taken August, 1911). No lameness. About one-half inch lengthening of right tibia.

This case illustrated the success of the thorough early operation and the completeness of repair without subsequent treatment of any importance. Unlike the first case quoted the periosteal new bone which seemed at one time to be forming about the upper part of the shaft disappeared later and left a normal looking cortex. The cause of this difference is one of the mysteries surrounding the behavior of the periosteum.

There is only one more important feature of the treatment of osteomyelitis which this series brings out. This is the effect of rest on healing. Many cases have recovered with good results under traction by hip splints or other forms of immobilization. In some instances a minimum of drainage, followed by long-continued rest and freedom from weight-bearing, has brought about excellent function, but it must be acknowledged that the healing though finally complete has been slow. Such results emphasize the obvious importance of freedom from strain during the repair of bone.

The following summarizes the ultimate results in so far as it has been possible to follow the patients:

Seven died as an immediate effect of the disease.

Forty are alive and well and have a perfect functional result. Of these, three had multiple infections.

Nine are stated in the Out-Patient records to be healed and in good condition, but have not been seen since.

Eleven have healed wounds but some deformity which in no case is disabling.

Seven have unhealed wounds.

Twenty have not been heard from since leaving the hospital.

CONCLUSIONS.

1. Osteomyelitis of the long bones in children originates in the ends of the diaphyses—rarely as a periostitis.

2. It principally attacks the weight-bearing bones.

3. The early or primary operation demands the removal of bone for purposes of drainage only. The infected medulla should be fully uncovered without doing unnecessary damage to the periosteum or endosteum.

4. Considering the power of regeneration of periosteum plus endosteum, early complete resection of a shaft is not advisable; therefore total resection later should be reserved for cases of total necrosis.

5. The Röntgen ray cannot be depended on for diagnosis in the very early stages, but is invaluable in following the course of the disease.

I am indebted to the Röntgenologists of the Children's Hospital, for the plates which illustrate this article, and to the members of the staff for permission to study their cases.

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THE DIAGNOSIS OF DIAPHRAGMATIC HERNIA.

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IN obtaining clinical histories from patients, it is well to inquire as to former injury much as one would ask about previous disease or operation. In this manner a clue may be obtained which will occasionally lead to eliciting data of vital importance in the diagnosis. This point is forced upon one's attention in reviewing the reported cases of diaphragmatic hernia. The history of trauma is very important evidence, as will be shown later.

For a discussion of the embryology, anatomy, and pathology of diaphragmatic hernia and related conditions, the reader is referred to articles by Sailer and Rhein, Strüppler, Königer, Beltz, and Becker. Further discussion on the diagnosis will be found as well. It will be impossible to give credit in the text to all authors whose papers have been reviewed. German clinicians have been very thorough in their study of diaphragmatic hernia, and we are indebted to them for most of our information. The fact that little has been written in English upon the differential diagnosis has led me to prepare this discussion.

Many diaphragmatic hernias are congenital, but most of these have been found in stillborn babes or in infants. Hernia occurs through the various normal apertures of the diaphragm. Hernia into the pericardial sac has been reported. Right-sided hernias have, as a rule, been small and have contained a small knob of liver. The stomach has been found in the right side of the chest in one instance. Nearly all diaphragmatic hernias, however, are left-sided, and the subject will therefore be reviewed from this stand-point. Most important for diagnosis are the congenital hernias of adults and traumatic hernias.

About 650 cases of diaphragmatic hernia have been re-

ported. Strüppler collected 500 cases in 1901. One hundred and seven reported cases have been found since then, and in addition 41 references have been collected which the writer has been unable to confirm personally. Most of these were either congenital hernias of babes or symptomless hernias discovered at autopsy. It would seem that 15 cases were diagnosed correctly during life. It is safe to say, however, that many mistakes have been due to the fact that the physician was unprepared for the condition; that the symptoms and signs of diaphragmatic hernia were often quite clear but were not elicited because of lack of familiarity with them. On the other hand, an occasional case has been reported in which all the refinements of Teutonic technic have failed to differentiate the condition.

The most important and difficult differentiation to make is that between diaphragmatic hernia and *elevation of the diaphragm (eventration)*. "Eventration" of the diaphragm was applied by Petit in 1790 to the condition of chronic idiopathic unilateral elevation of the diaphragm described by him. About 20 cases have been reported in the literature. As Königer suggests, it is not a good term surgically. The surgeon understands by eventration the condition in which a large part of the abdominal viscera is outside the peritoneal cavity. In fact, the word eventration might well be applied to diaphragmatic hernia, but not to high position of the diaphragm. Elevation of the diaphragm would be a better term; it is concise and its meaning is clear.

Elevation of the diaphragm is not an operative condition. Diaphragmatic hernia is generally surgical. The importance of deciding between the two conditions is therefore increased. Cases of elevation have been diagnosed hernia and unnecessarily operated upon.

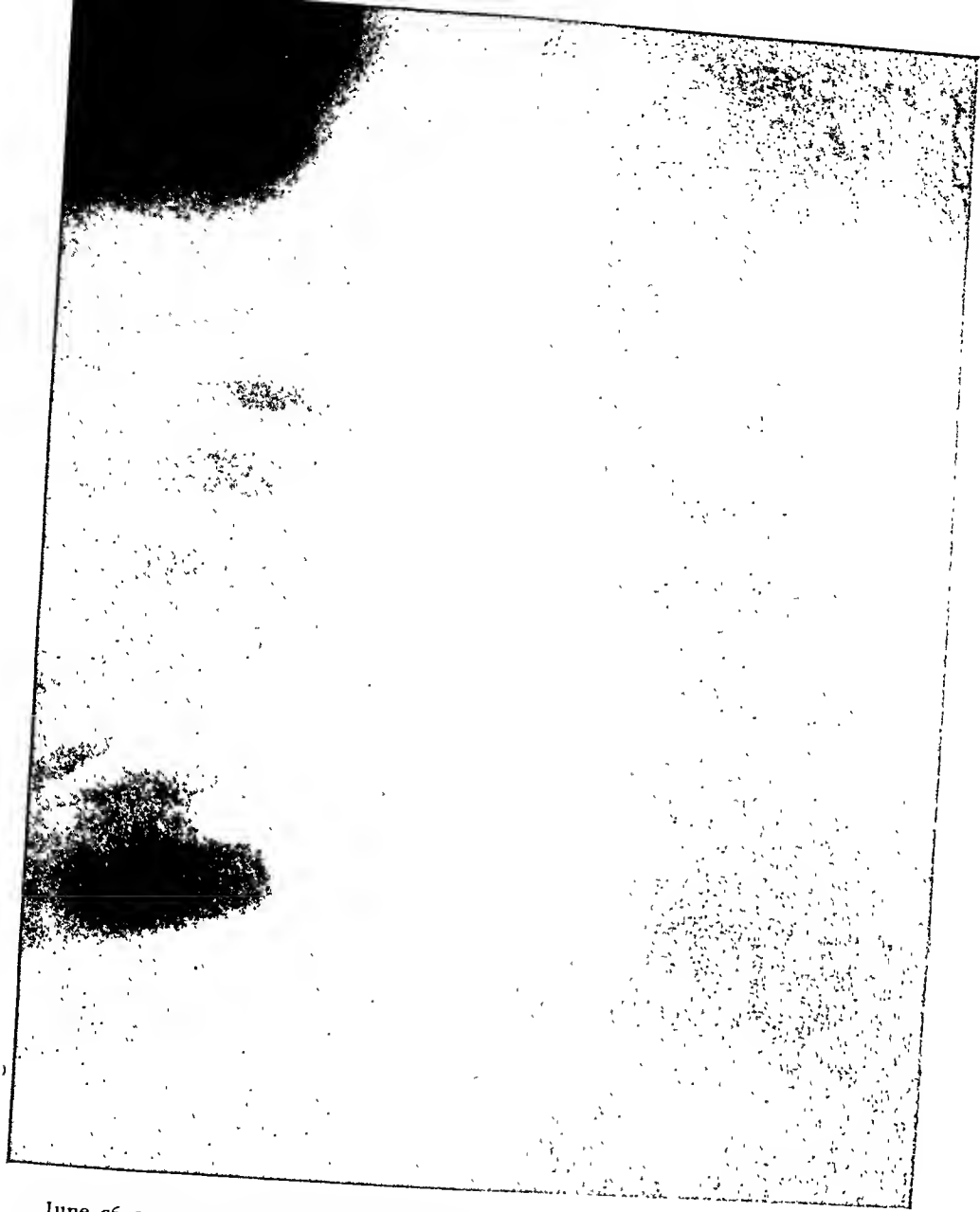
The diagnosis can best be discussed in a consideration of (1) the clinical symptoms, (2) the physical signs and (3) the radiographic and fluoroscopic findings.

If a history of severe trauma be elicited,—a crushing injury to the lower thorax or upper abdomen, as would occur if a man were caught between buffers; a severe blow to the upper

abdomen or lower thorax, as in being struck by a flying plank; a severe twist with consequent strain upon the organs of the upper abdomen and the diaphragm, as in being jerked suddenly from one position to another; a sudden doubling of the body with chest between knees, as in a sand or gravel slide; a penetration of tissues in the region of the diaphragm, as in a stab wound,—the existence of rupture of the diaphragm should be suspected. In the acute condition, marked dyspnoea with severe upper abdominal and left thoracic pains, possibly with symptoms of intestinal obstruction and hæmatemesis, completes the clinical picture.

Chronic cases of hernia, either congenital or traumatic, may give a less striking symptomatology and a history of much less severe injury. In this they approach the symptoms of elevation of the diaphragm, where abdominal pain, dyspnoea, and vomiting, though less severe, may recur in attacks, and these may be worse after trauma without rupture being present. Elevation is generally a congenital condition. A prominent symptomatology may only follow trauma. Dyspnoea, pain, indefinite gastric complaints may be of varying grades. Hæmatemesis has been reported. It is in these chronic cases then that the physical findings and radiographic and fluoroscopic study are more important.

Tympanitic percussion note, distant breath sounds, gurgling and tinkling sounds over the left lower chest, with hyper-resonant note and normal or slightly altered sounds over the left upper chest are common to both conditions. The heart is displaced to the right. In diaphragmatic hernia Litten's sign may be absent, and it has been suggested that the line of tympany may be less movable than in elevation. Dulness below tympany has been noted in diaphragmatic hernia and is probably explained in one case on record by the presence of spleen and in another by omentum. After giving a Seidlitz powder the signs may be much clearer and expansion of the stomach upward is likely to be more decided in hernia. Filling the stomach with water will cause partial flatness in place of tympany. Air or water pumped into the colon will likewise affect the tympany in the chest, if the



June 26, 1911. Case, diaphragmatic hernia, with the stereoscopic radiographs made of patient in the vertical position, the sternum next to the X-ray plate, care being taken to avoid any rotation of the spine on its long axis. The central focus corresponds to the level of the seventh dorsal vertebra.

We are viewing the thorax through from behind, therefore the right side of the print represents the right side of the thorax. These prints are facsimile reproductions of the original plates.

Note the position and outline of the pericardial shadow. The heart inclines strongly toward the right, its right border extending a greater distance to the right of the midsternal line than does the left border to the left of the spine.

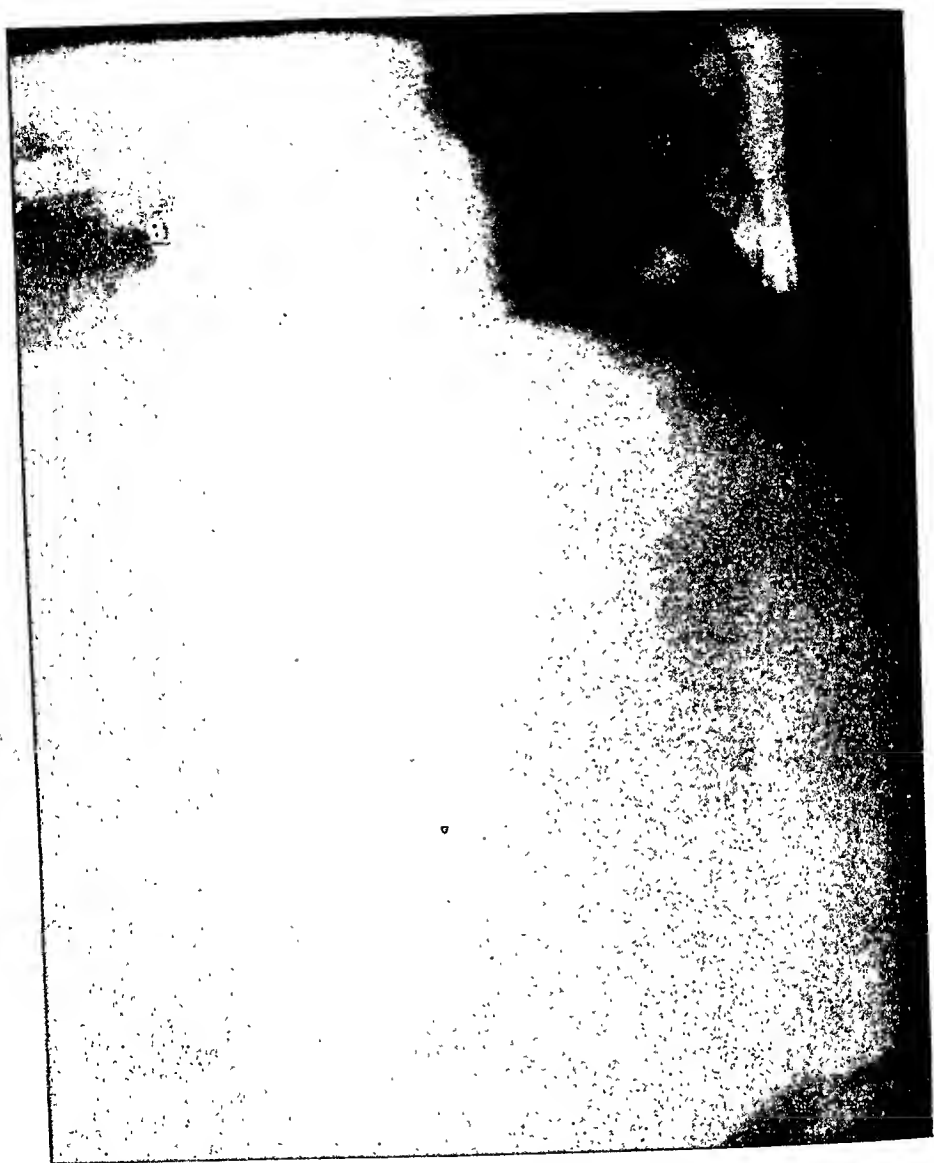
Both hiluses are abnormally dense, the left being markedly enlarged. Both apices are clear, and the pulmonary tissue is normal in all three right lobes and in the upper left lobe.

In the lower portion of the left thorax can be seen clearly a curved white line of greatly increased density. The proximal end of this line is opposite the level of the spinal juncture of the eighth rib on the left side. From this point the line curves outward along the eighth interspace to the ninth rib. Between this line and the upper border of the tenth rib is seen a dark area of greatly decreased density, through which one can clearly distinguish branches from the lower pole of the left hilus. The costal portions of three ribs are also visible. The left margin of the pericardial shadow is not clearly defined.

Note the clear-cut outline of the dome of the diaphragm to the right of the spine and compare it with the faint, indistinct outline on the left of the spine, which is to be seen just below the tenth rib.

The unusual appearance of the lower portion of the left thorax attracted our attention and suggested strongly the probability of a hernia of the diaphragm. A study of the stereoscopic plates supported this suspicion, and it was deemed important to establish the position of the stomach, for it seemed likely that the dark shadow below the abnormally placed curved line was due to gas in the stomach. With this end in view an emulsion of subcarbonate of bismuth and acacia was given the patient by mouth and a second set of plates made immediately, the patient being in the vertical position. (See Fig. 2.)

FIG. 2.



Radiographed immediately after the ingestion of bismuth subcarbonate emulsion. Compare with Fig. 1.

Note the line of demarcation between the white dense area and the dark area lying above it. The white shadow represents bismuth in the stomach, the upper border of the shadow representing the surface level of the emulsion. Above the bismuth is seen the gas bubble of the stomach. This is limited above by the wall of the stomach which we recognize as the curved line described in Fig. 1. Note the faint outline of the bismuth lining the esophagus. This can be traced upward to the limit of the plate. Figs. 1 and 2, together with the history, confirmed the diagnosis of hernia of the diaphragm.

Important diagnostic points demonstrated by the radiographs, Figs. 1 and 2: (1) the presence of a dark circumscribed shadow situated above the indistinct outline of diaphragm on the left side and bounded above by a curved dense band which does not maintain the dome shape typical of the normal diaphragm line, and limited mesially by the left border of the heart which is displaced strongly to the right; (2) the presence of the shadows of the lower branches of the left hilus showing through rarified area; (3) the location of the stomach and its great bubble by bismuth ingestion method.

colon be part of the hernia; if this finding be definite it may be regarded as an important point in favor of hernia. Examination after changes in position may furnish some evidence.

In radiograms of either condition the most noticeable abnormality is the existence of a curved shadow line with concavity downward in the left chest, and the problem is to determine whether this shadow line represents stomach wall as in hernia, a high diaphragm as in elevation, or both stomach wall and diaphragm as in elevation. (1) The shadow of elevation generally maintains a typical dome-shape whether it be low or high, or whether the radiograph be taken before or after distention of the stomach with CO_2 . The shadow of hernia may vary in outline, may be irregular or incomplete. (2) In diaphragmatic hernia the mottled appearance of lung tissue is visible through the gas contained in the stomach. This is not noted in elevation of the diaphragm even after extreme distention. These two observations are the most important ones in the radiographic differential diagnosis. If two curved shadows be present a radiographic or fluoroscopic examination after distention of the stomach should indicate which line is stomach and which diaphragm; if the lower line be stomach it will move up against the diaphragm line, and the pyloric end of the stomach will then unfold; if the upper line be stomach, distention upward into the chest will be almost unlimited. If the bow line shadow represent both diaphragm and stomach, distention will cause merely the above-mentioned unfolding of the pars pylorica.

The passage of stomach tube or lead bougie with subsequent radiogram does not seem to have yielded much additional information. Estimation of the intragastric pressure during inspiration and expiration in the two conditions has been attempted, but the results are not clear.

A series of X-ray plates following a bismuth meal should add some confirmatory evidence. The stomach may thus be identified as an organ lying in high position. The colon is almost always included in a hernia, and a plate showing bismuth in the colon above the level of the bow line in the chest would be conclusive evidence of a diaphragmatic rupture. As

far as I have been able to learn, this point has not been emphasized in the literature, but *a priori* it would seem true.

Fluoroscopic examination is useful in studying the movements of the shadow line. The excursion of the diaphragm line in elevation approaches in character the normal. On the other hand, congenital hypoplasia of the left lung is usually present with elevation of the diaphragm and consequently the movements of the diaphragm line may be far from normal. Indeed, a diaphragm shadow may not move with respiration in elevation and a stomach line may move in hernia. A "paradoxical expiratory displacement" has been noted in diaphragmatic hernia. During forced inspiration the right diaphragm descends normally, while the boundary line in the left chest ascends. During forced expiration the right diaphragm ascends while the boundary line on the left descends. Upon forced expiration by contraction of the abdominal muscles the shadow line on the left is again forced high into the chest. The movements on the left occur a little later than those on the right. This phenomenon has not been described in unilateral elevation in which the movements of the shadow line are likely to approach the normal in character, though they are less free in excursion. (See Becker's article, p. 186 *et seq.*).

The diagnosis then of diaphragmatic hernia from elevation of the diaphragm may, at times, be very difficult and may require all of our technical resources. It is quite likely that *rudimentary elevation* is more common than at present suspected and the condition should be more carefully looked for by clinicians.

The differential diagnosis of *pneumothorax* and diaphragmatic hernia is discussed in articles by LeConte and Ingalls. Particularly may there be difficulty when the pneumothorax is the result of injury. Dyspnoea may be present, and severe pain be experienced. The note over the left chest may be tympanitic, and tinkling sounds be heard. The tympany, however, is likely to extend to the top of the lung, and the breath sounds may be amphoric, vague, faint, or absent. In diaphragmatic hernia breath sounds and vocal fremitus

are not generally diminished, and the metallic sounds are associated with peristalsis rather than respiration. The positive coin test is more constant in pneumothorax. Vomiting is likely to be less continuous. Bulging of the interspaces upon closure of the glottis may outline the lower limit of the lung. The radiogram will generally furnish conclusive evidence of an unbroken diaphragm line. Pneumothorax has protean characteristics, however, and diaphragmatic hernia should always be considered before a diagnosis of pneumothorax is made.

Pneumothorax from rupture of the stomach in congenital diaphragmatic hernia with no history of injury has been reported. Such a condition might possibly be suspected after very careful consideration, but it is difficult to see how a diagnosis could be established.

Hydropneumothorax should be less difficult of diagnosis, especially if fluid be present in a moderately large amount. If succussion be obtained, it must be determined that it is produced in the pleura and not in the stomach. A movable line of dulness with signs of pneumothorax and a horizontal fluid line in the radiogram would be conclusive. Leucocytosis and symptoms of pus infection in addition to the findings described above would point to *pyopneumothorax*. Exploratory puncture would be conclusive.

Temporary elevation of the diaphragm has been reported. It has been thought to be the result of an affection of the phrenic nerve. In time the diaphragm line resumes its normal position.

A large cavity in the lower lobe may give metallic sounds and dyspnoëic symptoms. The cavity may develop suddenly after the expectoration of large amounts of sputum. The radiogram would show evidence of lung involvement elsewhere, and it should be possible to recognize the diaphragm line.

The name *subdiaphragmatic pyopneumothorax* has been given to the condition in which a pus cavity beneath the diaphragm contains gas. The most common cause is perforating ulcer of the stomach or duodenum. The diaphragm may be

elevated as high as the third rib. There may be tympanitic resonance over the area of the cavity. Metallic tinkle, succussion splash, and coin sound may be present. The chief difficulty would be in differentiation from pyopneumothorax. A history pointing to pre-existent abdominal disease and radiographic findings of elevation of the diaphragm should differentiate the condition.

In the case reported herewith, recurrent colic would have suggested *gall-bladder disease* or other abdominal lesion had a history of trauma not been obtained or had the findings on physical examination of the left thorax been less definite.

Pyloric stenosis has occurred from mechanical conditions in congenital diaphragmatic hernia, and the predominance of gastric symptoms has led to a suspicion of *ulcer*. *Esophageal stenosis* may be caused by acute hernia.

Four cases of diaphragmatic hernia have been operated upon at St. Mary's Hospital (Mayo Clinic). Three of these were reported in 1909 by Beckman. The case seen since then was diagnosed from the history and clinical findings by the writer and independently from a study of the radiograms by Selby.

L. J. (a55100), male, aged twenty years. Consultation June 26, 1911. Patient had been caught, together with four other men, two of whom were killed, in a sand slide one year previously; he was instantly and forcibly doubled up with his head between his feet, was unconscious for five to ten minutes, but easily revived. The stomach was empty at the time of the accident. He experienced no pain for a half hour after the injury. Then pain over the entire abdomen and chest became severe; shortness of breath was a prominent symptom, complaint gradually localizing to the upper abdomen and left side of chest and continuing together with some shortness of breath for two weeks. The patient remained in bed for five weeks. Pain across the lumbar region was also complained of, and the patient could not draw his legs up as he lay in bed for two weeks. Bladder and bowel control was good. He was able to walk in ten weeks. After this at times he complained of "sticking" pains across the abdomen and in the left side of the chest, and a sensation of the "stomach being lifted up under the chest." During the year which elapsed between the time of injury and the examination,

the patient had had attacks of severe epigastric pain lasting for an hour or two, with much bloating, sour eructation, and nausea, but no vomiting nor symptoms of intestinal obstruction. Pain often began in the right lower abdomen and later localized in the upper abdomen and left side of the chest. Soda gave some relief, but food did not. These attacks came at any time without relation to food and recurred every few weeks. There had been ten pounds loss of weight. Because of these attacks he consulted a physician. The family history and personal history were negative.

On physical examination a dull tympany was noted over the left side of the chest downward from the level of the sixth spine behind and anteriorly to the midaxillary line. Expansion did not seem to be markedly affected. Vocal fremitus was present over this area, though slightly diminished. The breath sounds could be heard, but were quite distant. Tinkling sounds could also be heard, and these were close to the ear and seemed to occur with peristalsis. Anteriorly from the midaxillary line the percussion note was quite dull, so that the left border of the heart could not be outlined. Heart dullness, however, extended three inches to the right of the midsternal line. Above the second rib in front and the spine of the scapula behind the percussion note was hyper-resonant and breath sounds harsh. The right lung seemed normal.

The X-ray prints, together with their descriptions, by J. H. Selby, will explain the condition found. It is necessary only to point out that the diagnosis from the radiograms was made chiefly from (1) the fact that the bow line in the left chest did not conform in outline to the dome shape maintained in elevation of the diaphragm, and was irregular and indefinite, particularly at its outer portion; and (2) the fact that lung tissue could be seen through the gas bubble below this line, which is not observed in elevation.

Operation July 5, 1911: An oval-shaped opening in the left half of the diaphragm, near the crux, large enough to admit the hand easily, was found. The hernia contained stomach, large intestine, spleen, small intestine, and the tail of the pancreas. (The presence of spleen probably explains the dullness found anteriorly on percussion of the chest.) The lung was completely collapsed. The stomach was distended and its walls were hypertrophied, doubtless as the result of mechanical obstruction. Nearly all of the transverse colon and 12 feet of the jejunum were

in the chest. The spleen was twice the normal size and most difficult to reduce. It was torn and required catgut sutures. Tremendous traction was exerted by the chest cavity so that the stomach and spleen showed a marked tendency to be drawn back into it. The opening into the pleural cavity was sutured with heavy linen for three or four stitches, then interrupted sutures were placed. The suture line was five inches long. The posterior margin of the opening was difficult to catch, the anterior quite easy. Additional sutures were placed where there was evidence of air aspiration along the suture line.

It is impossible to determine what portion of the abdominal contents became a part of the hernia as the result of opening the abdomen. In view of the evidence of decided negative pressure in the chest upon the attempt at reduction of the hernia, it seems likely that the original hernia was increased in size by the additional pressure from below. The lung was found more nearly collapsed at operation than one would have expected from the extent of visible lung tissue in the radiograms.

Four days after operation the patient was quite comfortable and easily examined. The temperature was nearly normal. There were no signs of fluid. Over almost the entire left chest the percussion note was exceedingly resonant, tympanitic, and so drum-like that it approached the quality of a musical tone. Vocal fremitus could be felt with difficulty and breath sounds were distantly transmitted. The heart remained displaced. A pneumothorax was evidently present. One week later there was some change in the percussion note. It continued, however, to be drum-like and very resonant. Breath sounds could be heard a little closer to the ear save at the extreme left base. Cardiac dulness was almost normal in outline. The patient left the hospital on the thirteenth day. He was examined repeatedly up to the time of his discharge six and one-half weeks after operation. No complications developed. The lower portion of the lung slowly completed its expansion. An X-ray plate taken six and one-half weeks after operation is reproduced. This shows almost completed expansion of lung tissue. The return to the normal is remarkable, when one considers that the lung had been partially collapsed for one year. The patient is at present enjoying excellent health.

On recapitulation then it is seen that a history of severe trauma, followed by upper abdominal and left thoracic pains.

dyspnoea, and vomiting, together with physical findings pointing to displacement of the stomach or intestine into the lower left chest and of the heart to the right, will ordinarily be sufficient for making a diagnosis of diaphragmatic hernia. If the history and findings be definite, this will be true whether the patient is seen immediately after injury or some time later. Röntgen ray findings will then be mostly of corroborative value. When, however, the injury has been less severe and the symptoms and signs less definite, and again in most cases of congenital diaphragmatic hernia, radiographic and fluoroscopic examinations must be relied upon for a differentiation of the condition. In interpreting the plates (1) a destruction of the definite dome shape characteristic of the normal diaphragm line, (2) the appearance of lung tissue through the gas bubble in the left chest, and (3) the demonstration of bismuth in the colon above the level of the bow line of the chest constitute the most important evidence in favor of hernia of the diaphragm. By fluoroscopic examination the "paradoxical respiratory phenomenon" may be demonstrated.

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¹The writer has collected a bibliography of 187 references. This will be furnished to any one particularly interested in a study of the condition.

MANAGEMENT OF THE OPENING IN THE TRANSVERSE MESOCOLON IN COMPLETING THE OPERATION FOR POSTERIOR GASTROJEJUNOSTOMY.

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THE opening made in the transverse mesocolon through which the stomach is brought out posteriorly in the operation of gastrojejunostomy was originally closed by fastening the torn margins with several sutures to the posterior wall of the stomach at some little distance (one-half to one inch) from the gastro-intestinal anastomosis. Later these sutures were omitted because they were thought to be unnecessary. In our experience the omission proved to be unfortunate, since in one case six feet of small intestine herniated through the opening into the lesser cavity of the peritoneum, and on the twelfth day a second operation was required for the relief of intestinal obstruction.

It has been advised by some authorities to suture the margins of the opening to the jejunum just beyond the gastro-intestinal anastomosis, and this plan is practised by a few careful surgeons, although several cases of obstruction have been reported as resulting from it. For some years¹ when performing this operation we have turned the margins of the opening underneath and sutured the peritoneum of the lower surface with three or four stitches to the suture line which unites the stomach and jejunum. This technic has proved very satisfactory in our cases. However, we have had two cases in which a fat transverse mesocolon, sutured in this way, caused secondary trouble because of adhesions forming in a collar-like mass around the stoma, and cure was not obtained in either case until a second operation was performed

¹ Mayo: ANNALS OF SURGERY, November, 1905.

Fig. 1.



FIG. 2.

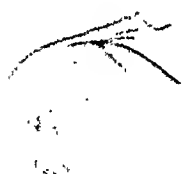
Timothy Peters
1912



...to the stomach.

in which the margins of the transverse mesocolon were dissected free and united to the stomach at a distance of an inch from the suture line of the gastrojejunostomy.

Fastening the margins of the opening in the transverse mesocolon to the gastrojejunal suture line by several sutures and neatly tucking the edges underneath so there will be no raw surface to become adherent (Fig. 1) is an excellent practice and suitable in the large majority of cases. In the occasional case, however, in which the transverse mesocolon is quite fat, there is danger that adhesions will form, and this technic should not be adopted in these cases, but rather the old method of suturing to the posterior wall of the stomach three-fourths of an inch away from the gastro-intestinal anastomosing suture line (Fig. 2).



SARCOMA OF THE SMALL INTESTINE.

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MALIGNANT growths of the large intestine are unfortunately comparatively common, carcinoma being the type of growth in the vast majority of cases, Mayo,¹ in a report of 100 resections of the large intestine, 61 for malignancy, only reporting one case of sarcoma. In the small intestine malignant growths are less frequent, and sarcoma in its various forms is by far the most usual type of growth. Kanzler² in 1906 could only find 23 published cases of carcinoma of the jejunum or ileum, to which he added two of his own. Primary sarcoma of the small intestine, however, is sufficiently unusual to make the following case worthy of report.

M. C., male, age twenty, native of Turkey. His family and previous history were negative. Six weeks before his admission to Bellevue Hospital on July 1, 1911, he noticed a mass in the lower part of the abdomen. It gave him an uncomfortable feeling when he was up and about, but the pain disappeared on lying down. Tumor grew larger and pain became worse, and he was obliged to stop work three days before admission to the hospital, because of weakness and discomfort. No urinary symptoms.

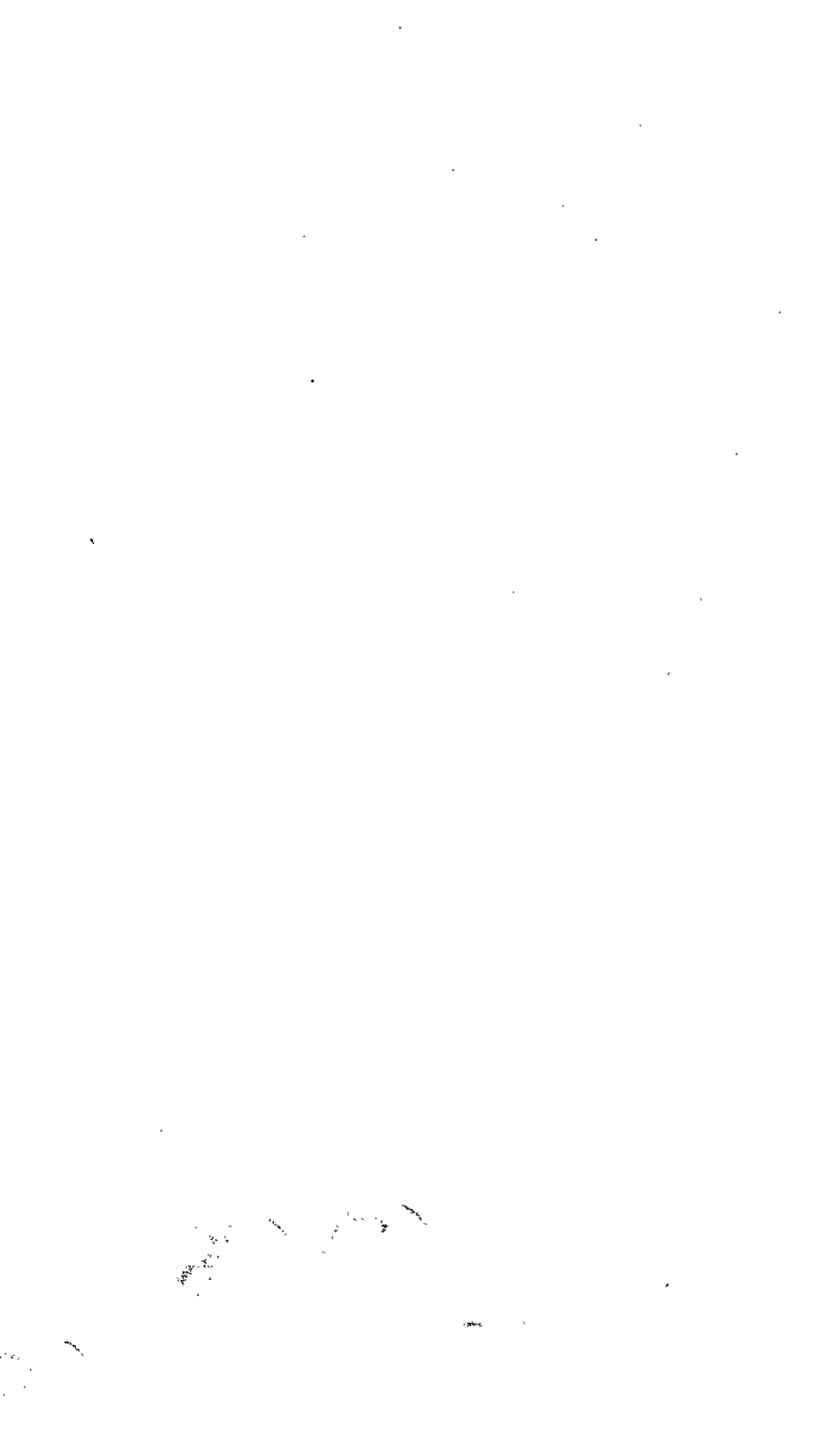
Physical examination showed a well-developed, anæmic looking but not emaciated patient. The abdomen was somewhat distended but not rigid, and there was no evidence of free fluid. In the median line and slightly to the right of it, midway between the umbilicus and the symphysis pubis, could be felt a firm mass about the size of the fist. It was somewhat irregular in outline and very slightly movable.

A median abdominal incision 12 cm. long was made over the mass, and on opening the peritoneum, an irregular white tumor involving a coil of the ileum and the glands in the mesen-

FIG. 1.



Sarcoma of small intestine, showing specimen removed at operation.



tery of the intestine at this situation was demonstrated. The tumor was adherent to the omentum and slightly to the peritoneal coat of the bladder, and in attempting to free and deliver the mass, the lumen of the intestine, the wall of which was apparently replaced by tumor tissue, was broken into. The tumor with at least 5 cm. of normal intestine on each side of the growth, in all about 45 cm., was resected and a lateral anastomosis performed. The wound was closed without drainage. The bowels moved without catharsis or enemata the day following operation, and except for a slight infection in the lower angle of the wound, due probably to contamination when the intestine was broken into, convalescence was uneventful. In the three months following the operation the patient had gained 22 pounds in weight. The pathological report showed lymphosarcoma.

The most complete report and analysis of cases of sarcoma of the small intestine are those of Moynihan,³ who gives brief reports of 40 cases submitted to operation up to 1906; and of Lecène⁴ (1907), whose article is the most exhaustive on the subject, and includes an analysis of 89 cases, both operative and non-operative. Since these statistics have been assembled, additional cases have been reported by Barling,⁵ McGlinn,⁶ Erdmann,⁷ Anderson,⁸ Stern,⁹ and Goebel,¹⁰ each one case, while Bondareff¹¹ reports two cases, LeRoy¹² reports three cases, one a case in which resection was performed, one case found at autopsy, and one occurring in a tuberculous woman. Munk¹³ reports six cases of sarcoma of the small intestine and one of the splenic flexure from the Breslau clinic between 1900 and 1908. In addition to these cases reported as sarcoma Fletcher¹⁴ reports a case of primary lymphadenoma and Scudder¹⁵ one of malignant lymphoma or lymphosarcoma of the small intestine for which resections were performed.

Pathology.—Round-cell sarcoma occurs in about half the total number of cases reported, spindle-cell and lymphosarcoma are the next most frequent varieties, while myosarcoma, alveolar sarcoma, fibrosarcoma, giant-cell sarcoma, myxosarcoma, and angiosarcoma are also reported. Lecène divides the cases into two kinds, circumscribed and diffuse, single tumors occur-

ring twice as frequently as multiple growths. Ulceration occurs in over half the cases, but cicatricial contraction, such as occurs in carcinoma of the intestine, causing stenosis and obstruction, is very unusual. The ileum is the most frequent site of the tumor, the jejunum, ileocæcal region, and junction of the duodenum and jejunum being involved in the frequency of the order given. The mesenteric glands are involved early in the course of the disease. Perforation of the intestine may occur.

Symptoms.—The first symptom noticed is usually the presence of the tumor in the abdomen or abdominal pains or discomfort. There may be some abdominal distention, but complete obstruction is rare. When obstruction occurs it is usually due to growths in the mesentery or to kinks or adhesions of the intestine. A small tumor may be the cause of an intussusception, which latter condition is not infrequently the first symptom of the growth. Anæmia and cachexia appear quite early, the latter being the usual cause of death. Ascites or malena is rare. There may be some elevation of temperature, but usually not.

Prognosis.—Of course without operation the prognosis is fatal. Lecène gives as the duration of illness four to six months in round-cell and lymphosarcoma; and eight to ten months in spindle-cell sarcoma. The primary mortality from operation is high—57 per cent. in Moynihan's series of 40 cases, five deaths being due to recurrence. The recorded cases since these statistics would lower this mortality. Bondareff states that recurrence occurs in 95 per cent. of the cases of round-cell sarcoma, although he reports one case without recurrence for three years, and Steinthal¹⁶ one free for three and a half years, and a case of spindle-cell sarcoma free for four years after operation.

Statistics, however, as to operative mortality or frequency of recurrence are of little value, as so many elements, such as size, distribution, situation, duration, glandular involvement, and involvement of neighboring structures, are the determining factors.

Treatment.—If the diagnosis is made early enough to com-

pletely remove the growth there is some prospect of a cure, but even if there is prospect of recurrence, the symptoms may be relieved and life prolonged by as complete a resection as possible, well clear of the involved intestine, with the removal of the mesentery and glands, followed by an anastomosis either by the end-to-end or lateral method.

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INVERSION OF MECKEL'S DIVERTICULUM.

WITH A REPORT OF SIX CASES.

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OF 78 cases of intussusception of all ages operated upon in the Royal Victoria Infirmary, Newcastle-upon-Tyne, from 1900 to February, 1911, five (6.4 per cent.) were due to inverted Meckel's diverticulum. The notes of these cases, along with one other which occurred in the practice of Dr. Modlin in Monkwearmouth Hospital, form an interesting addition to the already published records.

Gray,¹ with a case of his own, collected 40 cases, and it is now generally recognized that the condition is more common than was formerly supposed.

At the Summer Pathological Meeting of the Northern Division of the British Medical Association, 1910, I showed a series of Meckel's diverticula, some removed by operation and others found in the post-mortem room, and called attention to the different types met with and to the dangers attending their presence. For example, a persistent Meckel adherent to the umbilicus by a cord may either give rise to a secondary volvulus of the loop of small intestine from which it arises, or, acting as a band, may produce intestinal obstruction. Again, a Meckel of unusual length (6 in. or 8 in.) rarely exists throughout life without becoming adherent to some point in the intestinal tract and thus exposing the individual to obstruction or strangulation. Several cases of the kind have come under my own notice, and in some a persistent Meckel's diverticulum was found to be the seat of an acute inflammation which gave rise to gangrene.

The clinical picture in the cases where the intestinal obstruction is not marked may closely simulate that of acute

appendicitis, with or without abscess; and where the mass or tenderness is not in the appendix area, an acute Meckel's diverticulitis should always be taken into consideration in the diagnosis.

A Meckel's diverticulum with a narrow neck may encourage and harbor calculi which give rise to attacks of pain like gall-stones or appendicitis, the pain being due to the forcible contraction of the unstriped muscular tissue in the diverticulum in its effort to expel the calculi, as in a case reported by Sherren.² Here a fold of mucous membrane narrowed the lumen near the proximal end of the diverticulum, which was packed with calculi. In this case a diagnosis of appendicitis was made.

A case was recently reported by Albert Martin³ where a Meckel's diverticulum with a narrow neck contained a calculus the size of a horse bean. The end of the diverticulum was completely gangrenous and lay in an abscess cavity. There was also definite intestinal obstruction.

Another rare pathological entity arising from the remnants of the umbilical duct is referred to by Eisendrath.⁴ There is neither a communication with the bowel nor at the distal end with the umbilicus, but the intermediate portion, as a result of its own pent-up secretion, forms an enterocyst which may give rise to a large tumor analogous to a hydrops of the gall-bladder due to a calculus impacted in the cystic duct.

A small Meckel's diverticulum unattached at its peripheral end, with a broad base and a narrow apex, is the type most likely to become inverted into the intestine and cause intussusception of the ileum, and it is to this type that I wish specially to draw attention.

CASE I.—P. M., a boy aged five years, was admitted to the Royal Infirmary, Newcastle-upon-Tyne, on June 6, 1901, under the care of Prof. Rutherford Morison. He was perfectly well until the previous day, when he was seized while at school with severe pain in the abdomen and shortly afterward vomited. On

reaching home the bowels moved, but the pain persisted and came on in spasms every few minutes. He passed blood by the rectum and during the evening the spasms became less frequent and he occasionally slept. Vomiting persisted up to the time of his admission.

On the following day when admitted to the hospital his general condition was good. A sausage-shaped tumor could be felt in the right iliac fossa, but nothing abnormal by the rectum.

Professor Morison opened the abdomen over the tumor by a small oblique muscle-cutting incision in the right iliac fossa, and clear free fluid escaped. An intussusception (about 6 in. in length) involving the small bowel only was delivered, and reduction was effected without much difficulty. When this had been done a hole in the side of the gut was noticed, and something firm, subsequently found to be an inverted Meckel's diverticulum, was felt in the bowel just beyond this point. A small incision was then made at the margin of the Meckel in the long axis of the bowel and the diverticulum was everted. It was then excised and the wound in the ileum sutured transversely by Lembert sutures and the abdomen closed in layers of catgut. The wound was found to be healed on the ninth day after operation, when the skin sutures of silkworm gut were removed; the patient caused no anxiety after operation.

The specimen is a small Meckel's diverticulum which in the recent state was $1\frac{1}{2}$ inches in length and cone-shaped, with the broad end toward the bowel.

CASE II.—E. S., a youth aged fifteen, was admitted to the Monkswearmouth Hospital under the care of Dr. Modlin on July 6, 1904. While going about four days previously he had an attack of pain in the lower part of the abdomen. Shortly afterward he vomited and continued to be sick throughout the day.

On the following day he felt better and the bowels were moved, but at 7 P.M. he was again seized with severe pain and vomiting, which persisted until next morning, when he again had relief which continued until early in the morning of the day of admission. About 2 A.M. of that day the pain returned and persisted up to 6 A.M. On admission, about 8 A.M., he looked ill and complained of slight pain about the umbilicus. There was slight distention of the abdomen. No tumor was palpable, but he was more tender on the left side than on the right; there was no dullness in the flanks.

An enema given shortly after was without effect.

On opening the abdomen Dr. Modlin found an intussusception of small bowel into small bowel lying to the left side of the umbilicus. Attempts at reduction were of no avail as the layers of gut were so adherent, and a resection was done with end-to-end anastomosis. The patient died shortly afterward.

The specimen (Fig. 1), which had been hardened in formalin, was on examination found to consist (without reduction of the intussusception) of 22 inches of small intestine; and on removal of the bowel over the apex of the intussusception, the distal end of an inverted Meckel's diverticulum was seen. The diverticulum and the ensheathing layer of small intestine surrounding it were completely gangrenous and the oedematous mucous membrane stripped readily from its walls. The length of the diverticulum was $4\frac{1}{2}$ inches; it was distended at both ends and narrow in the intermediate portion.

CASE III.—C. S., a man aged twenty-five, a bricklayer, was admitted into the Royal Victoria Infirmary, Newcastle-upon-Tyne, under the care of Mr. Angus on November 21, 1908, with the history that on the morning of November 18 (three days before), while at work, he was seized with a severe pain in his belly after taking a drink of water. With the desire to defecate, his bowels were well moved, and about one hour later he vomited. The pain persisted and he continued to vomit at intervals up to the time of admission. The day before admission the pain came on intermittently and was accompanied by rumblings.

He stated that he had suffered from attacks of abdominal pain a few months previously which were always relieved when his bowels were moved.

On admission he looked ill; the pulse was 40, temperature 97.6° , respirations 80; his tongue was dry and he was vomiting dark, bile-stained fluid. He stated he had not had his bowels moved the first day of his illness and had not passed flatus.

The abdomen was not distended but rather slightly retracted. The whole wall was somewhat rigid and there was tenderness on pressure in the epigastrium.

A diagnosis of intestinal obstruction involving the small intestine was made and immediate operative interference was decided upon.

Mr. Angus opened the abdomen by a vertical incision in the

middle line reaching above and below the umbilicus. The small intestines were acutely congested and distended, and protruded into the wound. An intussusception, almost gangrenous, lay close to the cæcum. Attempts to reduce the bowel were unsuccessful, so the gut was resected, the ends being closed and a lateral anastomosis made between the small intestine and cæcum with a Murphy button. The abdomen was closed in layers of chromic gut and silkworm sutures for skin.

The patient bore the operation well and made an uninterrupted recovery. The button was passed on the seventh day after operation and he left the hospital healed and well on December 11, 1908.

Specimen shows about 6 inches of intestine without reduction of the intussusception, the apex of which is formed by Meckel's diverticulum. On reduction there is altogether about 12 inches of the bowel.

The Meckel was plum-colored and showed commencing gangrene most marked at its terminal end. The whole was completely inverted into the bowel and on reduction was about 4 inches in length.

CASE IV.—E. W., aged eleven, schoolboy, was admitted into Prof. Rutherford Morison's clinic in the Royal Victoria Infirmary on the evening of March 12, 1909. It was stated that he went to bed quite well three days before admission, but shortly after complained of sudden pain in the epigastrium and later vomited. The vomiting continued right up to the time of admission. The bowels had not been moved for two days.

On admission he looked very ill, his temperature was 128° , and his tongue was dry. His peripheral circulation was extremely bad.

The abdomen was markedly distended, tympanitic, and tender.

Rectal examination discovered a tumor in front of the rectum, which appeared to be fixed in the pelvis. There was no note of blood on the finger.

About one hour after admission Mr. Richardson opened the abdomen in the middle line below the umbilicus. Some free fluid was present in the peritoneal cavity. The small intestine was much distended and red. The pelvis was filled by an intussusception of small intestine into small intestine. The mass was gangrenous and irreducible and was about 7 inches in length.

The bowel was resected and a lateral anastomosis by simple suture performed.

After reducing the eviscerated intestine into the abdomen, the belly was closed in layers. The boy stood the operation badly and died shortly afterward.

In this case a definite intucking of the umbilicus was observed, but not until after death.

The specimen showed a gangrenous intussusception which, when reduced, measured 18 inches in length. Forming the apex was a small Meckel's diverticulum in the recent state about $1\frac{1}{2}$ inches in length, which had become completely inverted into the lumen of the bowel, and it, like the surrounding intestine, was completely gangrenous. The diverticulum sprang from the anti-mesenteric border and was distinctly cone-shaped, with the broad end forming its base.

Description of Specimen (Fig. 2).—The intussusception, which was reduced and everted prior to hardening in formalin, consisted of a loop of small intestine measuring 18 inches in length. The first 3 inches were normal in size and color, but directly below this point from the origin of the diverticulum the bowel was distended, œdematous, and plum-colored for 12 inches. The gangrene was most marked around the diverticulum, the terminal 6 inches gradually being more normal in appearance. The gangrenous Meckel's diverticulum sprang from the anti-mesenteric border. It measured $1\frac{1}{2}$ inches in length and, as will be seen from the accompanying drawing, was distinctly cone-shaped with the broad base toward the bowel; the circumference of the base was $2\frac{3}{4}$ inches. It was inverted into the bowel.

The peritoneal coat of the involved bowel was extensively ruptured on both sides, and the muscular fibres were plainly seen where the serous membrane had given way. No sign of any mesentery or vessels running from the bowel to the diverticulum were seen, the latter probably being rendered invisible by the œdematous condition of the peritoneal coat.

On inspection of the diverticulum from within, the broad base was found to be nearly occluded by œdematous mucosa which had become separated throughout nearly the whole of its length, the only firmly attached portion being that in relation with its apex. The small intestine immediately above the diverticulum showed a well-marked fold of mucous membrane extending round the greater part of the lumen of the bowel not unlike a valve of Houston in the rectum. A similar condition was found in Case VI.

CASE V.—W. J., aged three, female, was admitted under the care of Mr. Martin in the Royal Victoria Infirmary on November 9, 1910.

The present attack began one week previously. While playing

two hours after breakfast she was seized suddenly with a severe pain in the abdomen about the umbilicus and vomited shortly afterward. She remained in bed for three days, refusing any solid food and complaining of pain in the stomach. On the following day she became much worse. The pain came on in paroxysms and the vomiting continued up to the time of admission. The bowels were slightly moved at the commencement of the illness, but during the last two days prior to admission no flatus or fæces had been passed.

The mother stated that the patient had previously had similar attacks, which were always relieved by emptying the lower bowel with simple enemata and a dose of castor oil by the mouth.

The first attack was noticed in January, 1910, and they had persisted right up to the time of admission, coming on about every six weeks. The pain was said to be cramping in character and at times most severe, causing her to cry out. She had never passed blood per rectum. As a rule the attacks came on after she had gone to bed.

On admission, the child was well nourished but looked ill and in a lethargic condition. Pulse 126; temperature 99.8°; tongue dry and brown.

Abdomen: There was some distention in the upper part. Marked peristaltic movements were plainly seen in the region of the umbilicus on the right side.

The umbilicus itself was distinctly indrawn.

There was no rigidity of either rectus muscle and no tumor could be felt.

A rectal examination gave no further information. There was no blood on the examiner's finger.

Operation: Mr. Martin opened the abdomen in the middle line above the umbilicus. Distended loops of small intestine protruded into the wound, and on pushing these aside a tumor was found in the right hypochondriac region. On further examination this was found to be an intussusception, the apex of which reached as far as the middle of the transverse colon. It was easily reduced, and the bowel was in good condition except at one point where an inverted diverticulum arose from the anti-mesenteric border of the gut and formed the apex of the intussusception.

The diverticulum was reduced and excised, and the hole in the intestine was closed by a purse-string suture of silk and the

abdomen, was closed in layers of catgut. The child died twelve hours after the operation.

An examination of the specimen, which in the recent state was $1\frac{1}{4}$ inches in length, showed it to be cone-shaped with the broad end toward the bowel. The apex of the diverticulum contained a tumor, the size of a small hazel-nut, which on section proved to be an accessory pancreas. Section of the bowel wall at the base of the diverticulum when microscoped showed that it contained all the intestinal coats.

CASE VI.—Wm. L., aged twenty-nine, married, a brass polisher, was admitted into the Royal Victoria Infirmary in July, 1909, for hæmoptysis. After a short stay in the hospital he left for the seaside, but soon returned under the care of Mr. Angus, complaining of colicky pains in the abdomen. The griping pain was sometimes very severe and extended from the epigastrium over to the left hypochondriac region.

He went back to work in August, 1909, and except for the griping pains remained in good health until November, 1910.

On December 3 of that year he was readmitted with a recurrence of hæmoptysis, having had two attacks within three weeks.

On admission, he was a well-nourished, healthy-looking man. Temperature normal, pulse 88, and tongue clean. He stated that his bowels were usually constipated and that he required frequent purgatives.

Examination of the chest showed signs of early mischief below the left clavicle. The abdomen was normal.

On December 26 and 28 he had hæmoptysis and on December 31 he had an attack of abdominal pain and was observed to be slightly tender and distended in the epigastrium. The hæmoptysis recurred again on January 10 and January 19.

On January 25, while in bed, he complained of cramping pains in the abdomen and felt very ill. He vomited incessantly until 3 A.M. on the following day, when blood was noticed in the vomit. Shortly after the bowels were moved by enema and he felt much better.

On February 4, after tea, he was again seized with a sudden pain in the epigastrium, which made him vomit and roll about. On examination, a mass, which increased in size and became harder when he complained of pain, was felt in the lower part of the abdomen. The bowels were moved and he passed about one pint of bright red blood per rectum.

As his condition did not improve, Mr. Angus opened the abdomen by a median laparotomy on February 6. In the right lower abdomen was found an intussusception of the enteric type, the lower end of which was about 4 inches from the ileocaecal valve. On attempting to reduce the intussusception the bowel wall was split in several places through its peritoneal coat, otherwise the reduction was completed without difficulty. There was some free fluid present.

On palpating the bowel which had intussuscepted a lump was felt within the lumen running from a puckered depression on the anti-mesenteric border of the ileum. The loop of bowel was therefore resected, the ends being closed by Lembert sutures of linen thread, while a lateral anastomosis was performed by simple suture, and the abdomen was closed in layers by catgut.

Patient stood the operation well and continued in a satisfactory condition until February 11, when he complained of a sudden pain in the right side, which was followed shortly after by vomiting.

On the following day his abdomen was much distended, the pain continued in spasms, his pulse became rapid and small, and he died on February 14, 1911.

Post-mortem examination showed peritonitis limited to the lower abdomen. The anastomosis which was situated about 18 inches from the caecum was perfectly united, but it was found that a leak had occurred in the free end of the distal closed loop of intestine where a gangrenous patch had perforated from deficient blood supply.

Description of the Specimen.—The resected intestine in the recent state was about 2 feet 6 inches in length (Fig. 3). It showed some dilatation and hypertrophy of its walls, and about the middle of the loop, close to the mesenteric border and extending on to the greater part of the mesentery, was an area of subperitoneal extravasation. The serous coat of the bowel was thickened and had ruptured during the act of reduction at a point adjacent to the extravasation, and it was here that the intestine wall had been sutured.

Apart from this, the specimen showed that neither the mesentery nor the bowel wall was seriously damaged.

The Meckel's diverticulum, which measured $3\frac{1}{2}$ inches in length, is seen in the drawing (the intussusception of the bowel having been reduced). It was slightly club-shaped toward the distal half, which was fuller and measured 2 inches in circumference.

Immediately above the base of the Meckel's diverticulum the mucosa formed a distinct fold which appeared to diminish the size of the lumen of the bowel at this point.

The distal third of the diverticulum showed commencing gangrene, being of a dull plum color, while the remainder looked normal.

Viewed from the peritoneal aspect a portion of well-formed mesentery, in which the vessels were obvious, could be seen protruding from the opening at the point of entrance of the inverted diverticulum; this (mesentery of the Meckel) was continuous with the mesentery of the small bowel.

The entrance of the inverted Meckel easily admitted a fine probe which passed close up to the apex of the diverticulum.

REMARKS.—It should be mentioned that for a Meckel's diverticulum to become completely inverted into the bowel it must be free in the belly cavity. But this is not always the case, as adhesions, which fix the diverticulum to the adjacent small intestine, are apt to form, as is not infrequently found at post-mortem examinations. They naturally prevent inversion taking place and diminish the risks suggested by these cases.

It will be noted that in all six cases here recorded the whole of the diverticulum was inverted, and that there was an accompanying intussusception of the small intestine. The literature shows, however, that this is not always the case. Watson Cheyne⁵ points out that in a number of recorded cases the inverted diverticulum had merely been responsible for an acute abdominal attack, leading to either peritonitis, due to strangulation of its blood supply, or to gangrene. In his own case⁵ the greater portion of the inverted diverticulum consisted of mucosa, the serous coat at its base being the only portion that had become intussuscepted.

Several views have been suggested to explain the inversion of the Meckel into the small intestine.

Kütner⁶ considers this due to peristalsis of the diverticulum, which becomes inverted into the bowel in its efforts to expel its contents.

De Quervain⁷ expresses the opinion that a rapid flow of the intestinal contents through the lumen of the small intestine produces a negative pressure in the diverticulum, and thus favors its sudden inversion into the bowel.

My own view is that the occurrence depends upon a chronic inflammatory process affecting the mucosa at the base

of the Meckel, which results in the first instance in swelling of the mucous membrane and prolapse into the lumen of the bowel. This state of matters may account for pain and hemorrhage, and as the prolapsed mucosa increases in size and becomes more and more lax, it hangs into the bowel like a polypus which the intestine attempts to expel, thus leading to inversion.

My contention that the inversion of the diverticulum is due to chronic changes is borne out by the frequent history of previous attacks of hemorrhage and pain (usually cramping in character).

Coffey's⁸ case serves as an example of many others recorded, where previous attacks of abdominal pain and rectal hemorrhage have been in existence. He operated upon a boy aged seven, who, at the age of two, had a severe attack of abdominal pain, cramping in character, which persisted for thirty-six hours. Later he had these attacks regularly every two months, and they were always accompanied by blood in the stools; they persisted for four years. After a very bad attack he was operated upon and an intussusception found, the apex of which was formed by a small inverted Meckel's diverticulum which was in the transverse colon. The intussusception was resected and the cut lower ends of the ileum were united by simple suture. The child made a good recovery.

Of my cases, Cases III, V, and VI gave a history of previous attacks of abdominal pain, cramping in character. In Cases I, II, and IV no note was made as to this, and unfortunately it has not been possible to trace them.

Though there is no case on record, it seems quite reasonable to suppose that a Meckel may undergo a natural cure by becoming inverted into the bowel and separated by gangrene.

O'Connor⁹ reports a case of intussusception due to an inverted Meckel's diverticulum in a boy aged thirteen who, on the fourth day after the attack, passed per rectum 11¼ inches of gangrenous small intestines with a Meckel's diverticulum attached.

Abnormality at the umbilicus is another point which may be valuable in aiding diagnosis.

Treves¹⁰ states that a congenital hernia is not infrequently present with Meckel's diverticulum, and numerous other deformities of the umbilicus are recorded, from a mere tucking-in to a definite fistula.

Bidwell¹¹ operated upon a case of intussusception of the ileum due to an inverted Meckel's diverticulum in a boy aged three, on whom he had previously operated for a congenital umbilical hernia when the child was one year old.

In Gray's¹ case he observed the umbilicus to be raised and dome-shaped and the overlying skin to be of a bluish tint and considerably scarred.

A somewhat similar condition was observed in Case VI operated upon by Angus. The umbilicus was large and dome-shaped, but discoloration and scarring were absent. In Case V there was pronounced puckering of the umbilicus. A similar condition was found in Case IV, but the sign was not observed until after death. No note was made of the condition of the umbilicus in any of the other cases.

On careful examination of the umbilical cicatrix in post-mortem subjects dead from other causes, I have frequently found the umbilicus either raised or considerably indrawn where Meckel's diverticulum was present, so that without well-marked evidence of intussusception this sign alone is of little value as a point of diagnosis.

The diverticulum removed from Case V is of interest, having at its apex an accessory pancreas.

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- ² Royal Society Med., Nov., 1909.
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- ⁴ ANNALS OF SURGERY, 1910.
- ⁵ ANNALS OF SURGERY, December, 1904.
- ⁶ Beitrage zur klinischen Chirurgie, vol. xxi, 1898 (quoted by Watson Cheyne).
- ⁷ Centralblatt für Chirurgie, 1898 (quoted by Watson Cheyne).
- ⁸ ANNALS OF SURGERY, 1907.
- ⁹ British Med. Jour., 1894.
- ¹⁰ System of Surgery, vol. ii, p. 727.
- ¹¹ Lancet, September, 1907.

PRIMARY SARCOMA OF THE MALE URETHRA.*

REPORT OF A CASE.

BY ERNEST G. MARK, M.D.,

OF KANSAS CITY, MO.

Attending Genito-urinary Surgeon to Kansas City General Hospital.

THE occurrence of sarcoma in the urethra is most unusual, and its appearance as a primary growth in the male urethra is not recorded in the literature. To quote from a monograph by the writer, dealing with new growths of the urethra and presented before the 1908 meeting of this Association:

"To Hoening (*Berlin klin. Wochenschrift*, 1869, page 55) belongs the credit for the first reported case. Rizzoli (*Jour. de med. de Bruxelles*, 1875), Tillaux (*Annals de gynecologie*, 1889), Buttner (*Zeitschrift für Geo. und Gyneak.*, Bd. xviii, page 122), Ehrendorfer (*Centralblatt für Gyneak.*, 1892), Lejars (*Leçons de Chirurgie*), and Albarran have all reported well-authenticated cases of fibrosarcoma. Hall and Frick (*Jour. A. M. A.*, June 23, 1906) record a case of melanotic sarcoma, which they assume from the postmortem findings must have originated in the urethra. The case is unique, but the clinical evidence is well supported.

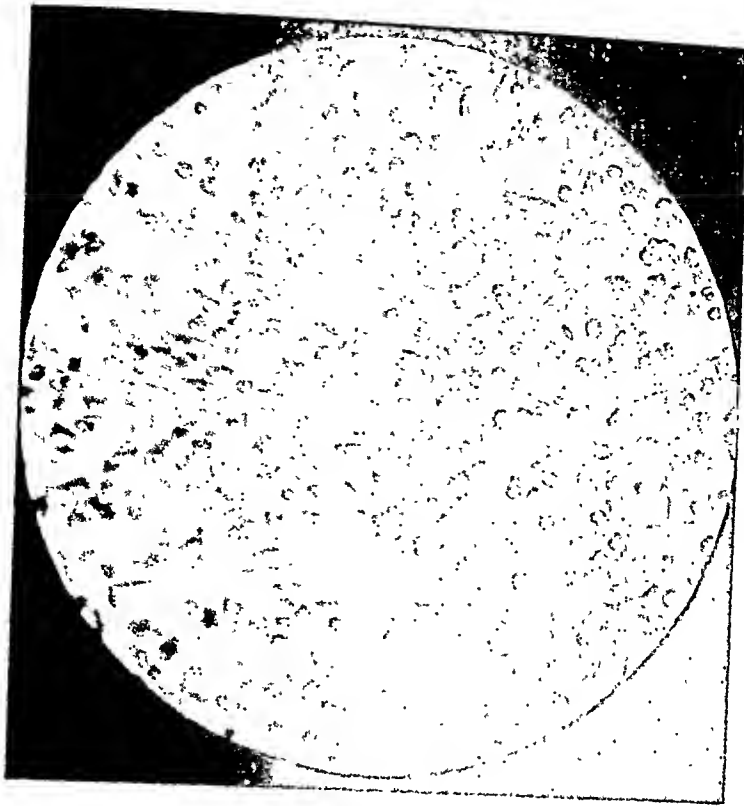
"Legueu makes the statement based on his investigations that sarcoma occurs exclusively in the adult female. In the case reported by Hall and Frick, the patient was a male, thirty-three years of age.

"Fibrosarcoma of the urethra pursue the same indolent course that characterizes their growth in other parts of the body. Their appearance is in no way typical and their clinical differential diagnosis from fibromata is almost impossible."

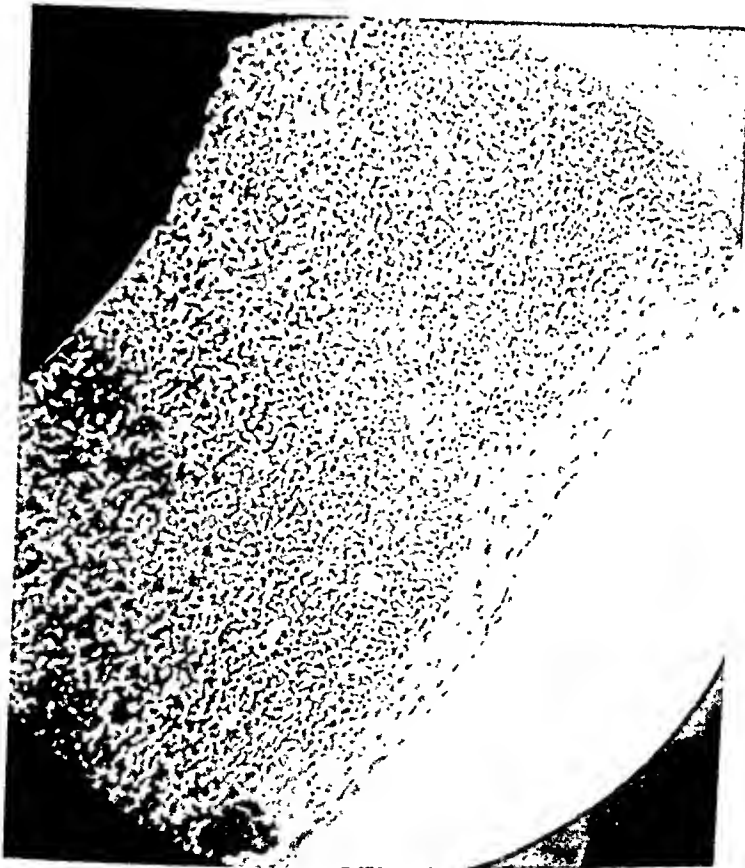
The case report of the patient observed by the writer follows:

* Read before the 1911 meeting of the American Urological Association.

FIG. 1.

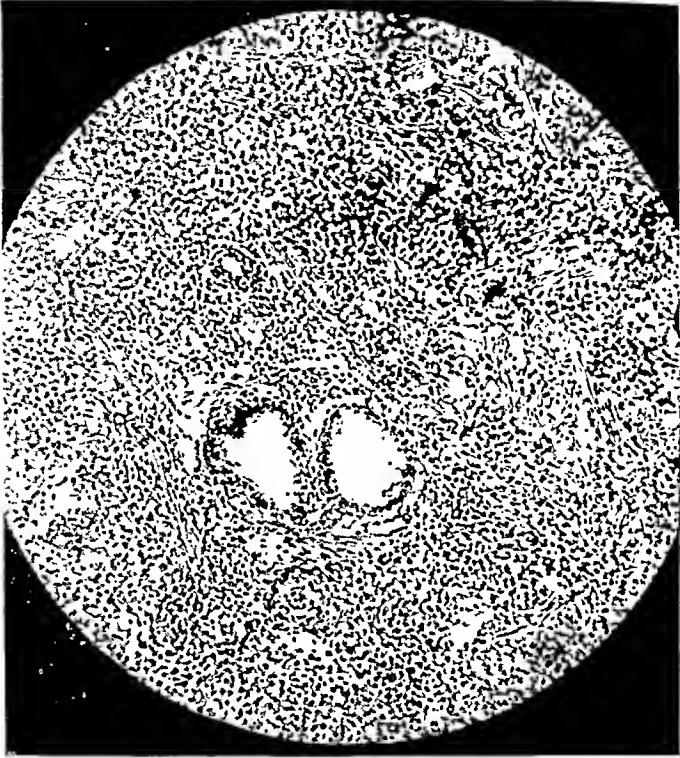


Photomicrograph showing relation of tumor cells to connective tissue.



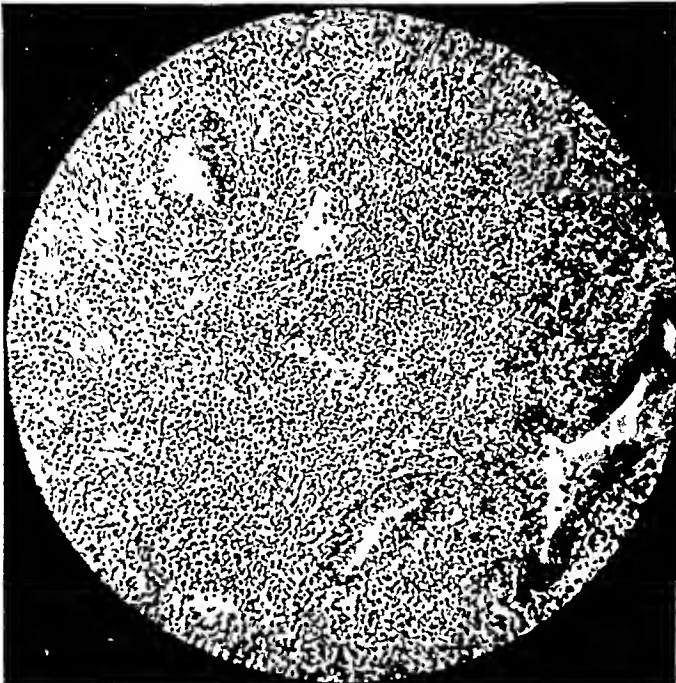
Photomicrograph showing relation of tumor cells to urethral epithelium.

FIG. 3.



Photomicrograph showing relation of tumor cells to urethral glands.

FIG. 4.



Photomicrograph showing relation of tumor cells to glands.

C. R., age twenty-four, Hereford, Texas; occupation, automobile mechanic, referred by Dr. J. D. Griffith. Family history negative. Seven or eight years ago, while on a ranch and out of reach of medical attention, he had an attack of what was, apparently from the history given, acute appendicitis followed by a generalized peritonitis, from which he recovered without apparent sequelæ. In March, 1910, he was operated on for an inguinal hernia. For some two or three weeks previous to operation he had noticed a slight burning or smarting in the pendulous portion of the urethra. After operation he was allowed no water to drink for a few days, and micturition caused a small lump or hardened, thickened spot was discoverable about one inch posterior to the glans penis in the spongy body. This was diagnosed without urethroscopy as an ulcer in the urethra and hand injections given. These injections caused the urethra to become inflamed. The thickened portion extended gradually backward. The patient described it as feeling like a ridge getting smaller both proximally and distally. There was very little pain or discomfort except on urination. Up to four or five months before presenting himself for treatment, no obstruction to the stream was noticed. Pollakiuria had been gradually increasing. At the time of entering the hospital there was a very small stream with accompanying dysuria. From the first there had been a serous discharge from the meatus, which gradually increased and became serosanguineous. For about six weeks previous to examination slight terminal hæmaturia was noticed. He had apparently lost none in weight and appeared well nourished.

Examination.—Abdomen negative. Thorax negative. Examination of the genitals revealed a fairly hard elongated mass, palpable from just posterior to the glans back through the scrotal urethra. This mass showed a decided tendency to become turgescient and much harder on handling without accompanying turgescence of the cavernous bodies. A slight serosanguineous discharge presented at the meatus. The scrotum and contents were normal. The prostate was small and showed no evidence of nodulation. Vesicles normal. No 10 F. bougie a boule was passed with difficulty from the mid-pendulous portion.

Urethroscopy.—No. 24 F. tube met obstruction just posterior to the corona. Under air inflation, very pale polypoid masses, irregular in outline, were observed, springing from the entire urethral circumference. Using the urethroscopic tube as a curette, these masses were removed with great difficulty as far back as the scrotal urethra. On account of the bleeding and the duration of the operative procedure, it was deemed advisable to postpone any further measures. The masses thus removed were left at the hospital for pathological examination, which was somehow neglected. Six days later the work was taken up where it had been left off, and, utilizing the same procedure as at the former operation, the remaining growths or portion of the growth were removed back to the anterior layer of the triangular ligament.

A cystoscope was now introduced without difficulty and examination revealed a high-grade cystitis but no evidence of new growth. The bladder capacity was much diminished.

Suprapubic drainage was instituted and regular soundings done. On account of the pronounced tendency of the growth to recur and the knowledge of its real character this drainage was made permanent. The patient refused radical interference and left the hospital about six weeks later. At the time of leaving the hospital, the growth was rapidly recurring.

The specimens removed were submitted to Dr. Frank J. Hall, whose report follows:

“Gross specimen consists of a number of whitish soft fragments. Section shows sarcoma poor in blood-vessels with small amount of stroma. The cells are of the large round type, with a suggestion of polymorphous cells with vesicular nuclei and pinkish staining cytoplasm. (Frozen section, hæmatoxylin and eosin stain.)”

A COMBINATION ABDOMINAL RETRACTOR.

BY DONALD C. BALFOUR, M.B. (Tor.),

OF ROCHESTER, MINNESOTA.
Associate Surgeon to St. Mary's Hospital.

IN describing the retractor, a cut of which is inserted, no claim is made to originality, in that the instrument is essentially a combination of two well-known retractors, each suitably modified.

It has been the practice for many years in the clinic at St. Mary's Hospital to obtain exposure in pelvic work by the use of a spreading retractor of the Simpson type, aided by a hand retractor in the lower end of the incision. Recently lateral retraction has been procured by the self-retaining instrument of Gosset, which accomplishes the same result as the Simpson, but is somewhat more simple of construction, easier of application, and more efficient, inasmuch as it holds its position firmly when introduced.

For about a year we have also used a retractor of the Doyen type in the clinic at St. Mary's Hospital. This retractor is eminently satisfactory so far as pelvic exposure is concerned, but seems unnecessarily cumbersome. The chief objection is not in the retractor itself, but concerns its upright position between the thighs of the patient, which must be of different sizes for different patients. This change is not easy of accomplishment and renders the technic more complicated.

The obvious usefulness of these two retractors, *i.e.*, the Gosset and the Doyen, rendered evident the desirability of combining the merits of both into a single retractor.

An instrument was therefore made from a special design and, with some slight modification, is in use in this clinic at the present time. Reference to the cut renders a detailed description of the instrument almost unnecessary. The Gosset is changed to obtain a fixed point to hold the middle blade of

the instrument. This is procured by an extra bar on which is a sliding set screw. The Doyen is fitted with a short flat handle about an inch wide and six inches long, with a central open portion throughout the entire length. The application is very simple. After placing the self-retaining portion in the wound with the cross-bars toward the lower end of the incision, the necessary lateral traction is procured by separating the limbs of the instrument. The second part is now placed in the wound and tracted into the lower part of the incision until the desired exposure is obtained, when the screw is clamped, fixing the blade.



TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 4, 1911.

DR. R. G. LE CONTE, President, in the Chair.

A CHILD WITH RUDIMENTARY LEFT UPPER EXTREMITY (PEROBRACHIUM).

DR. PENN G. SKILLERN, JR., exhibited the patient. He was a male, aged 5 years, the second youngest child of healthy and normal Irish parents. Five brothers and sisters healthy and well formed. Patient presents no other abnormalities or defects, congenital or acquired.

As shown by the sketch (Fig. 1), the left upper extremity is very rudimentary, extending but little more than half way down the chest wall, to which it is adherent, instead of down nearly to the left knee. The limb terminates in a free foot-shaped projection, of which the heel corresponds to a rudimentary thumb and the remainder to a partially flexed and fairly well-developed index-finger.

Movements of the limb are principally elevation of the shoulder and flexion of the remaining dwarfed segments.

External examination reveals a fairly well-developed clavicle, an acromion, a very small humerus, an elbow-joint, small forearm bones, and in the index small nodules of bone corresponding to a carpal, a metacarpal, and a phalanx. The presence of the elbow-joint was confirmed by Dr. Astley P. C. Ashhurst.

Internal examination by Röntgen rays served to orientate the skeleton of the limb more accurately. The first skiagram taken (Fig. 2) shows a comparatively well-developed clavicle, a rudimentary acromion, coracoid process, humerus, forearm, carpal, and digit bones. As it was afterward determined, the scapular spine was obscured in this picture by the shadow of the clavicle. Because the glenoid rim and elbow-joint were not well shown, another skiagram was taken (Fig. 3). Now the upper extremity of the humerus was found in juxtaposition with a rudimentary glenoid, from which there faded away below an indistinct axillary

border. The scapular spine is now shown. The position of the elbow-joint is brought out by the partially flexed forearm. The radius and ulna here form a common shadow.

Epiphyses are lacking, and the bones have advanced but little in development beyond a stage represented by the early months of intra-uterine life.

It is not claimed that this interpretation of the skiagrams is wholly accurate, but it is the result of careful study, in which the author sought the aid of Professors G. A. Piersol, H. K. Pancoast, G. G. Davis, and T. T. Thomas, and the artist, Mr. Erwin Faber. The case occurred in the service of Dr. B. A. Thomas, at the University Hospital.

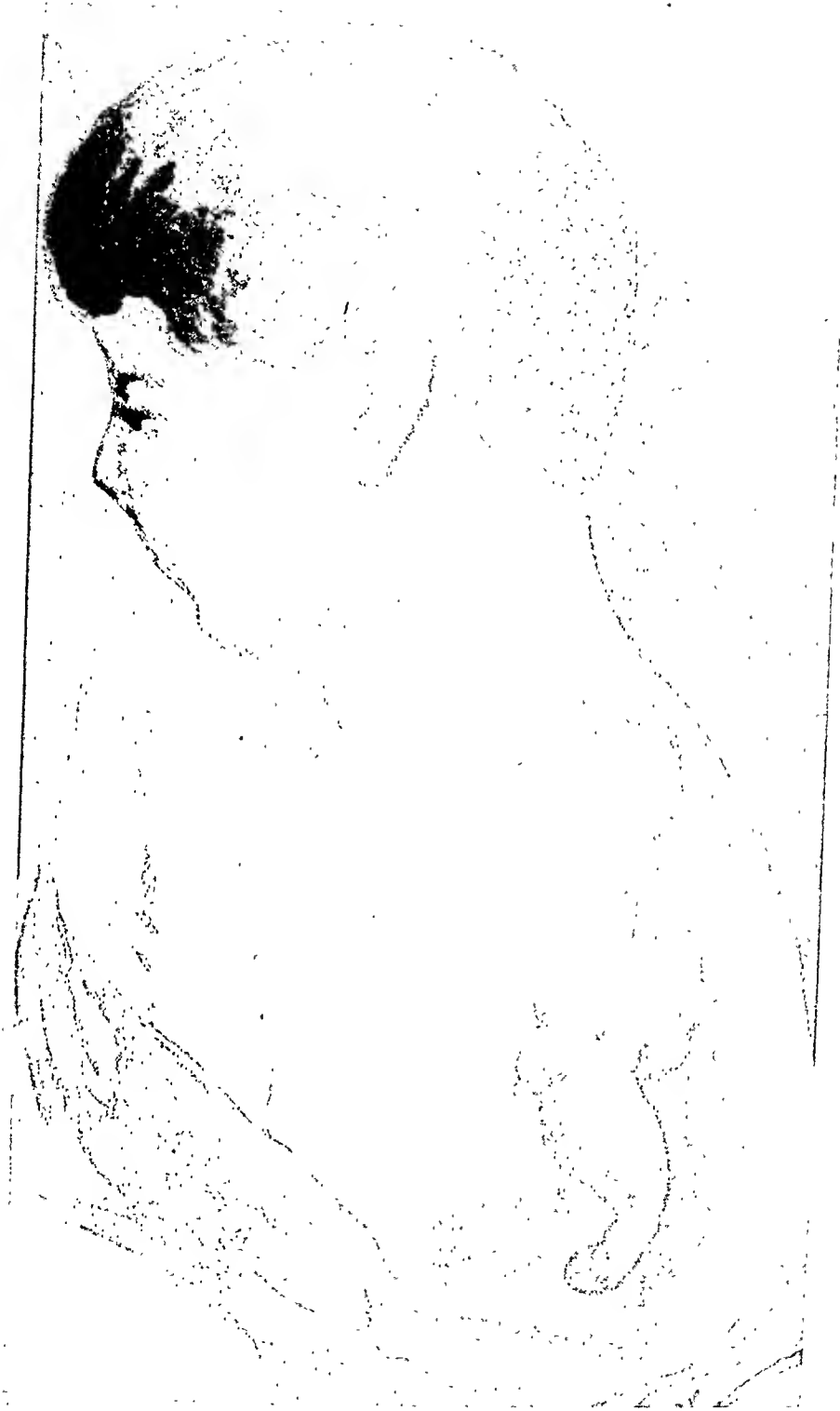
To crown the interest of the case there is the usual history of maternal impression. The mother, when two months pregnant, answered the door-bell in response to a mendicant who exhibited to her his left shoulder, which bore the stump remaining after a railroad-amputation of the upper extremity.

LITHOTOMY UNDER SPINAL ANÆSTHESIA.

DR. HARRY S. CARMANY read the history of a man, 61 years of age, who was admitted to St. Timothy's Hospital with a vesical calculus. On account of a chronic cough it was thought a suitable case for spinal anæsthesia, which was employed according to Professor Bier's original method, between the fourth and fifth lumbar vertebræ, first using $\frac{1}{2}$ c.c. of a 1:1000 adrenalin solution, along with 2 c.c. of normal salt solution, waiting five minutes and then introducing 2 c.c. of a 1 per cent. solution of cocaine. After waiting ten minutes the operation was proceeded with. Anæsthesia was complete from twelfth rib down. Operation was started about 5.10 P.M. and completed about 5.40 P.M. Did not have return of sensation until 7 P.M. and was not complete until 9 P.M., although at 5.50 patient had profuse sweating, was slightly excited, felt a little faint, and had a subnormal temperature. Strychnine and atropine were given with prompt improvement. At 8.30 was given alcoholic rub, as sweating was still profuse. The stone was removed suprapubically, with drainage tube for four days, when permanent catheterization was instituted for a week or ten days. Convalescence uninterrupted. Suprapubic wound healed four and one-half weeks after operation.

DR. B. A. THOMAS called attention to another method of

FIG. 1.



Rudimentary left upper extremity (perobranchium).



removing vesical calculi, particularly small ones not more than half a centimetre in diameter, namely, by the use of Young's cystoscopic rongeur. About six weeks ago he had a case in which there were two small calculi which were removed by this method. The device consists of a beaked instrument shaped somewhat like an ordinary urethral sound which opens out on a hinge on its posterior surface like a clam shell, and passing through the hinge, as it were, is a straight cystoscope through which the stone is seen while grasping it with the expanded tip. One of the two stones removed by the use of this instrument was really larger than is applicable to this method and therefore had to be crushed before it could be removed.

DR. JAMES P. HUTCHINSON said apropos of spinal anæsthesia, that some years ago Dr. Le Conte and he were abroad together, and saw Dr. Tuffier use his spinal anæsthesia. After returning home they tried it regularly in the first fifty or more cases of operation below the umbilicus; it was uniformly successful, but the large majority of patients objected to the mental depression and, in many cases, the headaches that followed its use. They then discontinued its use, but he had recently taken it up entirely in prostatic and bladder cases if the patients would allow it.

It has an advantage which Dr. Carmany did not mention, and that is that there is absolute and complete relaxation of the patient. In a bladder case, using ether, one is apt at times during the operation to get rigidity of the abdominal wall, which never occurs in spinal anæsthesia. Spinal anæsthesia also has a great advantage in that in elderly individuals the patient can be gotten out of bed in four or five hours after the operation, after the effect of the paralysis of the lower limbs has subsided, while with ether they are apt to have nausea and vomiting and be upset for a day or more, with a much greater probability of subsequent pneumonia.

DR. ASTLEY P. C. ASHHURST referred to a recent paper by Dr. Bevan, of Chicago, in which he unqualifiedly condemns spinal anæsthesia. There is no doubt whatever that there are a great many cases where local anæsthesia will do as well. It will not do to use local anæsthesia in removing an enlarged prostate, but it can be used in doing suprapubic cystotomy and even in removing a stone from the bladder. If a surgeon has a little patience and a light hand, and keeps the operating room quiet, he can do many operations under local anæsthesia without resorting to the more dangerous spinal form.

DR. CHARLES F. NASSAU believed with Dr. Ashhurst that if simpler means were tried the same results could be attained without treading on such dangerous ground in many cases. If one has persevered in obtaining a more or less extensive experience with local anæsthesia, infiltration anæsthesia, there are very few operations within reason to which the method cannot be applied. Hernias, bowel resections, exploratory sections, amputations of the arm and thigh can be perfectly well done under local infiltration and nerve blocking. There is no objection to combining anæsthetics, for instance, in operating for a tightly strangulated femoral hernia, which is one of the more difficult types under local infiltration because it is a little hard sometimes to reduce the constriction without causing the patient some pain. In such a case the patient can be given a few breaths of nitrous oxide. One can benumb the patient thoroughly with morphine before beginning, and personally he would feel that while operation should never be refused if strongly indicated in the aged, yet he would go a long way before he would use spinal anæsthesia, the use of which may possibly result in later trouble. He knew of two patients who, he had been told, are wrecks from spinal anæsthesia used for the purpose of operating on hemorrhoids.

DR. ROBERT G. LE CONTE said that he had had very much the same experience as Dr. Hutchinson. When they were together some years ago at Tuffier's clinic, they were impressed by his method and technic of administering spinal anæsthesia and with the results obtained at the time of operation. Under this stimulus they tried it on a number of cases at the Pennsylvania Hospital. Their conclusions were that in old people, with bad arteries, bad kidneys, and poor circulation, this anæsthetic was the safest one that could be used. He had done a number of grave operations on patients of this type, without shock or variation in the pulse-rate. He had not had the good fortune to do major operations under infiltration anæsthesia with as little disturbance to the nervous system and to the circulation as under spinal anæsthesia. He had, therefore, become a firm believer in, and a strong advocate of, spinal anæsthesia in this limited group of cases.

DR. GEORGE G. ROSS thought one of the great difficulties with regard to stovaine is that there is no standardization of the dose with regard to the weight or age of the patient, and hence what would be an overpowering dose for one man may totally

fail to anæsthetize the next one. He had seen one fatality under stovaine in a case of strangulated hernia; in this case he thought a local anæsthetic would have been preferable. The patient died promptly after the stovaine was thrown into the membranes around the cord. He had seen a number of cases where active and violent convulsions resulted from the combination of strychnine and stovaine. It took considerable time and prolonged artificial respiration to tide the patients over the immediate effects.

THE INDICATIONS FOR AND AGAINST THE OPERATIVE TREATMENT OF SIMPLE FRACTURES.

DR. JOHN H. GIBBON read a paper with the above title, for which see page 329.

DR. RICHARD H. HARTE said that the operative treatment of fractures which has been so much before the profession of late years is largely the outcome of the imperfect treatment accorded these patients. Again, it is largely due to lack of interest on the part of many surgeons who should know better how to treat fractures than they do; they rarely take but a passing interest in fractures until they find they are resulting badly, their attention being called to this fact by the house officer.

He was exactly in accord with Dr. Gibbon in regard to the treatment of special fractures. Take fractures of the shaft of the humerus, around the anatomical and surgical neck. Those of the anatomical neck are comparatively rare. There is very little disposition for entanglement and the question here is more of reduction and retaining the arm in position after reduction; a satisfactory result follows in the great majority of cases, particularly if the suggestions presented in this paper are followed. Again, the same thing may be said about the elbow-joint and in the shaft of the humerus. In the treatment of all fractures the question should come up with regard to the displacement: What is causing it, is it muscular, or is it a result of the bones being driven past each other by violence, or due to entanglement? In his experience, except where there is entanglement, one can usually reduce all fractures. By entanglement he meant pieces of muscle, fascia, etc., getting between the ends of the bones, and these can be eradicated only by exposing and removing the obstructing material.

There are certain bones and certain portions of bones in which entanglement is more frequent, each as in the central portion

of the bones of the thigh because of the great masses of muscle surrounding them, in the forearm, and also in fractures of the tibia. In fractures of the shaft of the thigh Dr. Gibbon has very properly emphasized the importance of bringing the lower fragment to the upper fragment in fractures high up; Dr. Agnew laid stress upon this point years ago. He used a double inclined plane and made extension a little below the knee.

He was strongly of the feeling that if surgeons will carefully analyze their fractures and find exactly what the displacing element is, they will get better results than they are getting to-day. Often on taking an X-ray, when the fragments are apparently in position it is found that a great deal of displacement exists, particularly laterally; the plane of fracture is almost straight, but the bones are separated from one-half to three-quarters of an inch with tissue between; these cases should be operated upon. He did not know any class of surgery where the judgment of the surgeon is more taxed than to say what cases should be operated upon and what should not. The reason ununited fractures occur is because a band of fascia or piece of muscle has gotten between the ends of the bones.

Another important point is the necessity of going into these cases before it is too late, not after subjecting them to extension for four, five or six weeks. The surgeon should find out as soon as possible whether he had gotten the fragments in position; then he should not wait too long, because it complicates the operation materially; the changes for repair are much better the earlier the operation.

With regard to Pott's fracture, he had seen such cases operated upon, but he did not think they should be. If treated intelligently, by carrying the foot well in a fracture box with two pieces of bandage and binding the leg around, or putting on the Dupuytren splint, one will get satisfactory results. It gives a chance for the deltoid ligament to recover itself, and a patient after a fracture of this sort should walk on the outside of the foot because the ligament will gradually give way, and in time if the foot is well carried in it will just about balance itself.

DR. JOHN B. ROBERTS said that he recalled looking a few months ago over a paper by a New York surgeon, in which were reported quite a large number of cases of fractures of the thigh bone operated upon because they had been united in

malposition or because they could not be reduced. He read carefully his statements as to the previous line of treatment and in a large proportion the patients had never been subjected to efficient non-operative surgical treatment. Nearly all of them had been treated by long external wooden splints or other splints, or by an inclined plane, and not by extension with Buck's stirrup and pulley or other methods of maintaining traction. For one to operate on fracture of the shaft of the femur, because it could not be reduced, when he never had tried continuous traction with 25 or 30 pounds weight, is in his opinion an error. If he had previously seen these cases himself and treated them in a rational manner, doubtless operation would not have been considered necessary. He thought Dr. Gibbon to be entirely right in stating that the great majority of fractures can be treated by non-operative means; and that when this is not successful the failure is due to either the patient's own negligence, or to a want of mechanical sense and attention on the part of the surgeon. It is often due to the fact that the after-treatment is conducted by young medical men or by nurses, who are not familiar with the mechanical principles involved and the anatomical displacements. Each individual case should be treated in accordance with the mechanical and anatomical problems involved. In a great majority of fractures of the humerus or the bones of the forearm and of the bones of the lower extremity, the surgeon will obtain good results without operation, if he has a mechanical turn of mind and gives intelligent and frequent supervision to the patients. It will not do, however, to leave them to doctors or nurses without experience and knowledge of non-operative methods. He discovered not long ago that fractures of the femur treated by him in a hospital had been accustomed to have a bedpan about two or three inches high put under them by the orderly while the broken limb was weighted with from 15 to perhaps 30 pounds. He only found it out by seeing the thing occur as he walked into the ward. That is the kind of thing that surgeons' indifference and negligence in fracture cases have allowed to go on in hospitals; and it perhaps accounts for the lack of good results in many cases. Dr. Gibbon is right, that attentive surgical observation will prevent many bad results.

It seems proper to lay stress on the treatment of fractures by gypsum splints. The average surgeon nowadays pays no

attention to the use of plaster of Paris as a means of making a perfectly fitting splint.

The X-ray is a valuable adjuvant in diagnoses; but it is a most incorrect aid unless a surgeon supervises the taking of the picture and then uses his own fingers and clinical sense to act as a source of contrast and addition to the X-ray plate. In some hospitals the patients are taken out of bed, put on a stretcher, and taken to the X-ray laboratory by a probationer nurse or inexperienced resident. It is perfectly possible for the X-ray man to make almost any kind of a picture by changes in the line and angle of the rays. We are liable to pay too much attention to the X-ray picture and think we have a badly set fracture when the truth is that the appearances are factitious. It requires often the combined knowledge of the radiologist and the surgeon to correctly translate the shadow picture.

DR. GWILYM G. DAVIS said that Dr. Gibbon's paper brings up one aspect of surgery that is suggestive, and that is the relation of the conservative to the radical, and the question of the conservative treatment of surgical affections of the extremities. When it comes to a discussion as to whether the treatment of certain cases shall be conservative or radical, it devolves upon the surgeon to be qualified to decide that question. In other words, he should know what can be done by conservative means; to be qualified to treat a part conservatively he should understand conservative methods and should be willing to take the time and trouble to become familiar with and carry out such methods. The tendency in the development of surgery during recent years has been toward visceral surgery; the consequence has been to drift away from extremity surgery. Visceral surgery has developed to such a tremendous degree that it has been practically impossible for many surgeons to keep pace with the developments of surgical science in conservative fields, and we therefore see them devoting their attention almost exclusively to operative and visceral surgery, the abdomen, brain, etc., to the exclusion practically of such things as fractures and other surgery of the extremities. Still retaining their position as general surgeons to institutions, these cases of fracture, etc., fall under their care although they have not kept pace with the development of the conservative side of the art. The consequence is that they must do one of two things, either relegate the treatment of these cases

to others, or undertake them themselves. Some do one thing, some another. When they undertake the treatment themselves, they are confronted with the alternative of either treating them inefficiently conservatively, or else operating upon them, and likewise inefficiently, and it has been a matter of surprise to him that Mr. Lane's work, commendable as it is along some lines, has aroused such enthusiasm. No one could admire his technic more than the speaker, and yet the choice of his cases leaves much to be desired. Exactly what course will be pursued by the surgical profession is a matter of great interest. If the general hospital surgeon is going to treat fractures in the future, he will have to begin to study fractures from a conservative stand-point, and perhaps after the furor which has recently occupied the surgical world for visceral surgery has passed, there may be a reaction, and then these cases will again receive the attention which they deserve. In the meantime, however, some institutions are finding a solution of the problem by turning such cases over to the members of the staff who are accustomed to deal with things from a more conservative and mechanical stand-point.

DR. JOHN H. JOPSON asked whether the amount of extension applied by Dr. Gibbon relatively to the arm and forearm and thigh. In the past he had often been content with an insufficient amount of extension in the treatment of fractures of the thigh, and lately he had been in the habit of increasing the weight with less regard to the age of the patient, until satisfied with the reduction obtained. He did not know whether in doing this the ligaments of the knee-joint might be injured. The question of the strength of these ligaments must be considered both in the treatment of simple fractures by Buck's extension, and in the newer methods of reduction, for example, that employed by Dr. Lemon of Milwaukee, which he recently demonstrated in this city. In Lemon's apparatus, one in which the mechanical details have been worked out in the nicest manner, the extension which is used to effect reduction is applied to the ankle by means of a special gaiter, which is removed after the plaster cast has set. The amount of extension employed can be carried up to 150 pounds. In Martin's method the extension is applied directly from the upper end of the lower fragment. Lemon's apparatus he applied for in one case and Martin's apparatus as modified and perfected by Eliason he had used very recently, and

undoubtedly if there is no danger in the application of this very great amount of force below the knee-joint there is an advantage in the use of Lemon's apparatus, because in Martin's method you have to remove the retractor before pinning or plating the fragments.

Another question in the experience of the author is shock in operating on fractures of the femur, especially in the upper portion. As everyone knows there is oftentimes serious shock in operations on the femur, and in cases where the hemorrhage is slight may it not be that the traction itself can be responsible for this shock?

In spite of the opposition manifested in some quarters to the operative treatment of fractures, one must realize that in selective cases it has come to stay, and that we will be in the future less and less satisfied with incomplete and imperfect reduction of fractures.

DR. JOHN H. GIBBON (in closing) said that he thought highly of Lane's plates and that there is no technic better than his, but what he had seen is a plate employed in fractures and applied to bones where it should not be used; for instance, on the olecranon, the internal malleolus, and the patella. Lane has done the best work of any man in the treatment of fractures. His selection of cases, however, seems bad, that is, he takes cases which we would not operate on. A great many of the cases which are reported by many operators are those which the surgeon has not seen until a resident or his assistant says, "We have a bad result and I guess you will have to operate," and this after partial union has taken place and a lot of callus developed. Such a case should have been operated on just as soon as it was discovered it could not be gotten into proper position. Late operations give bad results.

As to the residents: He finds residents get enthusiastic about the same things their chiefs get enthusiastic about. If one shows a certain amount of interest in fractures and demonstrates to the resident what he can do, for instance, in fractures of the upper end of the humerus by abduction, he will be impressed and become interested, and if, on the contrary, one pays no attention to the fracture cases, he will only call attention to them when they are in bad condition for operations and beyond mechanical correction. Surgeons want to familiarize themselves

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with the improvements that are made in the mechanical treatment of fracture just as much as the improvements in technic. General surgeons are competent to treat fractures, but when it comes to operating on them the man who understands this should be very familiar with such work.

There is one point he wished to emphasize, and that is the matter of continuous traction. Ten pounds kept up for a week will do more than 30 pounds for half an hour. Regarding the shock in thigh fractures, he thought that the shock accompanying and following fractures of the thigh is often one to fat embolism. He had no proof at all, excepting that large amounts of fat are eliminated in fracture by the urine. The student is to-day not receiving the amount of instruction in mechanical treatment of fractures that he should and it must be made up to him during his internship by those under whom he serves.

FRACTURE-DISLOCATION OF THE SHOULDER.

DR. WILLIAM J. TAYLOR reported the history of a man of 50 of lax fibre and poor muscular development, who in the spring of 1910 made a misstep and in jumping forward to regain his balance placed his foot upon a small rug lying upon a hard-wood floor. The rug slipped and threw him forward, and in his efforts to save himself from falling, he extended his left arm, his hand coming with great force against a wall. A dislocation of the shoulder resulted. As the accident happened in the country, there was some delay before he could be seen by a physician. Finally a man of large experience and a most excellent practitioner gave him ether and after a careful examination reduced the dislocation without difficulty, using his foot in the axilla. The arm was then bandaged to the side. Forty-eight hours afterwards he came into town and was seen by Dr. Taylor for the first time. Patient suffered great pain; there was marked swelling, and the bandage was so tight that blebs had formed on the forearm. Dr. Taylor could feel the head of the humerus in its broken place, but the swelling about the shoulder was so great that an accurate examination was impossible. There was an extensive ecchymosis. The swelling gradually subsided, but pain was persistent and an X-ray taken of the shoulder showed the true nature of the injury. The anatomical neck, or rather the articulating surface

of the bone, had been shelled off and remained against the chest-wall beneath the pectoral muscle.

He operated by making an incision along the posterior axillary fold and dissected down past the vessels well into the axilla. The piece of bone could be easily felt through the wound, but so near to the vessels and nerves that it was impracticable to remove it by this route for fear of doing serious damage. Through the same incision he now dissected below the vessels and toward the pectoral muscle and by splitting it the piece of bone was removed. The remainder of the head of the humerus was in place in the glenoid cavity and the capsule of the joint firmly united. The joint was moved freely and a drain of iodoform gauze introduced into the cavity from which the piece of bone had been removed. Convalescence was uneventful, and the patient has a perfectly useful arm and a movable shoulder-joint.

DR. JOHN H. JOPSON said that he saw a case almost identical with this in an old colored woman in the Polyclinic Hospital Dispensary, with an injury of the shoulder which he diagnosed at first as fracture of the anatomical neck. The tuberosities were pulled upward so that no depression was felt below the acromion. The X-rays showed the head in the axilla, and he made an anterior incision and removed it.

DR. CHARLES F. NASSAU said that four years ago he had an exactly similar injury occur to a patient of his. The man was very stout and flabby, extremely poor physical condition particularly due to dissipation, and he fell out of a low window to the porch, was brought to the city, and was supposed to have had a dislocation which was practically reduced, but the pain persisted. An X-ray was taken by Dr. Sweet, and it was after that that he came under his care. He feared very much to do anything with it, but the X-ray, although not good, was sufficiently so to show a thin "butter plate" torn from the head of the humerus and driven down between the head of the bone and the chest wall under the pectoral muscle. He made an incision through the anterior edge of the deltoid, smoothed the edges after removing the loose piece, and closed the wound with not more than three stitches. That man has a perfectly good arm. With persistent and long-continued massage he has obtained a good result with a freely movable joint.

DR. GWILYM G. DAVIS said that when he was Dr. T. G. Mor-

FIG. 4.



Fracture-Dislocation of

[illegible]

ton's resident he came in contact with a case very similar to this, in which he made an incision just under the edge of the pectoralis major and withdrew the head of the articular surface as did Dr. Taylor. As a person grows older, the line of fracture recedes until it reaches through the anatomical neck, but in this case it has been a little lower and includes a little portion of the upper part of the tuberosity, and on the illustration will be seen a fragment which looks as if part of the tuberosity had been torn.

DR. JOHN H. GIBBON said that he had an X-ray picture taken of every fracture he treats. The time to take the picture is after the reduction. It is important to teach men that the thing they must do is to have a picture taken, and if not it is up to the patient, because so frequently patients turn up who never had a picture taken and have a bad position. Everyone taking a fracture must ask for an X-ray plate. As Dr. Harte has shown, it may sometimes mislead. He had seen two fractures that from a clinical point of view were perfectly apparent but which did not show in the X-ray plate because it was only taken in one line. With a stereopticon picture there is no excuse for a misinterpretation. We often do not need it as a diagnostic means, but rather as a confirmation of the proper reduction of the fracture; he does not consider it a criterion as to the result.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, Held at the Presbyterian Hospital, November 22, 1911.

The President, DR. CHARLES L. GIBSON, in the Chair.

RECURRENT PANCREATIC CYST.

DR. CLARENCE A. McWILLIAMS presented a woman of 50, who was first admitted to the Presbyterian Hospital on October 25, 1910, her chief complaint being pain in the left upper abdomen. Her history dated back fourteen years, when she had her first attack of pain, which started in the left upper abdomen and radiated upward to both shoulders; never down or around to the back.

Examination of the upper abdomen showed a transverse, indistinct mass, about the size of a grape-fruit, with its lower border extending four inches below the navel. It was smooth, not tender, dull on percussion, and deeply situated.

On October 28, 1910, an exploratory laparotomy was done through a median incision. Above the navel and occupying practically the entire left upper quadrant of the abdomen, was found a very large, smooth, cystic swelling, which lay behind the stomach and extended up to the diaphragm. Its position was that usually occupied by the pancreas. A needle was passed through the lesser omentum, and then, with a trocar and cannula, at least a quart of fluid, turbid, odorless, and chocolate colored, was drawn off. A tube was then sewn into the cystic opening with purse-string suture. The abdominal wound was then closed about the tube, and the patient made an uneventful convalescence.

During the first 24 hours, about eight ounces of fluid drained through the tube. Two weeks after the operation, this fluid gave a faintly alkaline reaction, with a specific gravity of 1022. The fat-splitting reaction was present, with a marked reaction; the

diastolic ferment was also present as well as a marked trypsin reaction.

The tube was left *in situ* for eighteen days, and then drawn outward so that its end lay just inside of the abdominal wall. The patient left the hospital on December 4, 1910, afterward visiting the accident ward for dressings. The sinus in the abdomen continued to discharge for three months longer, and then healed entirely and remained so.

The patient was readmitted to the medical division of the hospital on September 1, 1911, complaining of pain in the left hypochondrium, which was at times dull, at other times sharp. She had lost flesh and strength, and suffered at times from nausea and vomiting. On physical examination a very indistinct soft mass, not tender, was felt in the left upper quadrant of the abdomen. A Wassermann reaction was negative, but a Cammidge reaction was positive.

Operation, September 15, 1911: An incision was made through the old scar. Through the stomach could be felt a smooth, cystic mass, about the size of a grape-fruit, lying below the diaphragm in the left upper quadrant. The gastrocolic omentum was incised, the cyst wall exposed, and the cyst aspirated and opened, and a section of its wall removed for examination. A finger inserted through the wall of the cyst extended upward to the diaphragm and to the left as far as the spleen. The cyst wall was sutured to the abdominal wall, as complete incision of the cyst was impracticable. A tube was left inside of the cyst.

A microscopical examination of the cyst wall showed no epithelial lining, and no pancreatic tissue was found in the sections. An examination of the fluid from the cyst showed the presence of weak ferments.

The patient made a smooth recovery from the operation. On September 25, an examination of the faeces showed poor pancreatic digestion. Trypsin and diastatic digestion were diminished, and the total undigested fat was increased to 68 per cent. The patient was then given extract of pancreas, and on October 6 the total fat had diminished to 15 per cent., showing improved pancreatic digestion.

Dr. McWilliams said he attributed the recurrence of the cyst in this case to the fact that at the first operation the cyst wall was not sewn to the abdominal wall, causing it to close too soon.

RETENTION CYST OF THE PANCREAS.

DR. ELLSWORTH ELIOT, JR., presented a man, 46 years old, a native of Hungary. His occupation was that of a salesman. His family history was negative, and his past history, with the exception of the fact that he had suffered from constipation for the past ten years, was unimportant.

About a fortnight prior to the patient's admission to the Presbyterian Hospital, on October 2, 1911, while walking, he had a sudden, sharp pain in the left side of the abdomen. This was increased on deep inspiration, and upon examination the patient noticed a swelling just below the left costal margin; this was painless on pressure. The sudden pain, which persisted, was most severe in the left hypochondrium; it did not radiate, and was relieved by lying down on the left side. There was no vomiting. The appetite and digestion remained good up to a few days before admission, when the patient had a sudden chill; no fever. The swelling gradually increased in size.

Upon admission, the patient's temperature was 98.5°; pulse, 88; respirations, 22. In the left upper quadrant of the abdomen, bounded by the midline and on a level with the umbilicus, there was an ovoid swelling about the size of a large cocoanut. It was elastic to the feel and dull on percussion. It moved with respiration, and was not adherent to the overlying skin. Upon inflating the stomach, the mass almost entirely disappeared, but only temporarily.

The peritoneal cavity was opened by a vertical incision through the upper outer part of the left rectus. A large cyst immediately presented, pushing the gastrohepatic omentum forward. The cyst wall was exposed by a reflection of the divided gastrohepatic omentum to either side, and after examination of its content the portion of the cyst wall was excised and the edges sutured to the parietal peritoneum. The cavity was drained by a rubber tube and the incision in the abdominal wall closed by the usual suture.

After the operation the discharge was abundant and contained pancreatic ferment for three weeks. It then suddenly diminished and during the past month has varied considerably in amount. At present there is practically no discharge and the wound healed.

FRACTURE OF THE OLECRANON.

DR. McWILLIAMS presented a woman, 50 years of age, who was admitted to the Presbyterian Hospital on September 20, 1907, ten days after she had sustained a fall upon her elbow.

On examination, one could feel a fracture of the olecranon, with separation of the fragments of about half an inch. An X-ray photograph showed a transverse fracture of the olecranon, about an inch from its upper extremity, the fragment being displaced upward and backward by the triceps so that its fractured surface looked posteriorly.

An incision five inches long was made over the posterior surface of the olecranon, and the line of fracture exposed. A hole was drilled transversely through the lower fragment, a quarter of an inch from its posterior surface. A moderate sized aluminum bronze wire was then passed through this hole, threaded on a needle and passed through the triceps tendon, just above the upper fragment. The wire was then drawn taut, and the ends twisted together on the outer side of the ulna. When the skin stitches were removed on the eleventh day, primary union had taken place.

An X-ray picture taken recently, four years after the operation, showed the wire in its original position. The fracture had firmly healed, so that even its location could not be made out by palpation. Flexion and extension were perfect, and there was no pain. The question of whether it is wise to use an unabsorbable suture material about joints is brought up by this case. Usually chromic gut is preferable, but this case shows that wire may be used. Its advantages are that much more freedom is allowed in the position in which the joint is placed immediately after the operation, as well as earlier subsequent active and passive motions. The skin sutures of silk or silkworm gut when placed about joints should be left *in situ* for more than the ordinary length of time, at least ten or twelve days, to prevent subsequent separation of the skin edges.

TYPHOID PERFORATION: CHOLECYSTITIS.

DR. McWILLIAMS presented a man, 39 years old, who was operated on March 19, 1911, at 4 P.M. He was suffering from typhoid fever, and was then, it was calculated, in the twelfth day of the disease. He had slept well the entire preceding night,

and at 7 A.M. complained of a sharp pain in the abdomen, in the region of the bladder. At eight o'clock he was given an enema, which brought away yellow fluid and some soft fæces. Two hours later he felt nauseated and refused milk.

When Dr. McWilliams first saw the patient, at three o'clock in the afternoon, his pulse was 96, temperature 103° , with a white blood-cell count of 13,600. There were rigidity and tenderness of the right rectus, more marked below than above. There was also some tenderness in the left lower quadrant. There was no distention; liver dulness normal; flatness in the flanks. A rectal examination elicited slight tenderness.

Operation, 4 P.M.: The abdomen was opened under cocaine through the right rectus muscle without the slightest pain. Upon opening the peritoneum, some fluid escaped. On attempting to draw the cæcum into the wound, the pain was so severe that ether by the drop method was given. The cæcum and ileum were then drawn out, and a small perforation, the size of a knitting needle, was found about eight inches from the ileocæcal valve. The perforation was closed by a purse-string Pagenstecher silk suture. There was considerable fluid, with a small amount of fæces in the pelvis, which was washed out by means of a catheter attached to an irrigator, by the side of which a suction tube was passed. Two rubber tubes were inserted to the bottom of the pelvis, and the abdominal wound was sutured around them.

On the following morning the patient's temperature had dropped to normal, and remained so for two days, with a pulse of about 100. Then there was a gradual rise in temperature. There was no vomiting. The slight distention was relieved by colon irrigations. The tubes were removed on the eighteenth day, and gauze strips substituted. On the sixth day after the operation, the temperature became higher, reaching 103° on the sixteenth day. This temperature persisted for 21 days, and was due to a cholecystitis, as shown by a very tender gall-bladder region, with muscular rigidity. The leucocytes were as high as 21,800 and the polymorphonuclears 88 per cent. After this the patient made an uninterrupted recovery, and has been well ever since, with no subsequent intestinal disturbance nor pain in the gall-bladder region.

Dr. McWilliams said that in the Presbyterian Hospital they had operated on 20 cases of typhoid perforation since 1900.

BILATERAL LYMPHOSARCOMA OF THE BREASTS. 439

Their results had not been brilliant, for only four of these 20 recovered—20 per cent. Armstrong (*British Med. Jour.*, Oct. 29, 1910) stated that in the Montreal General Hospital, from 1897 until May, 1910, there were 2051 cases of typhoid fever, with 93 perforations—4.53 per cent. Of these, 78 were operated on, with 24 recoveries—30.7 per cent. In six of these cases, more than one perforation was found—7.7 per cent. The perforations were generally not far removed from each other.

LATE CONDITION AFTER EXCISION OF THE SUPERIOR MAXILLA FOR SARCOMA.

DR. C. A. McWILLIAMS presented a man of 40, who was admitted to the Presbyterian Hospital on November 15, 1909, with a hard, bone-like tumor, about the size and shape of a walnut, occupying the right superior maxillary bone, and extending into the right nostril. It was raised as a globular swelling from the side of the nose and face. The skin covering the tumor was not movable, being firmly attached to the growth, which felt like a part of the upper jaw. On the right side, beneath the upper lip, the growth could be seen involving the gums in irregular, nodular projections, which bled easily. The orbit was not involved. The first evidence of the growth had been noticed seven months before. A section of tissue removed showed it to be a giant-celled sarcoma.

Operation, November 16, 1909: After a preliminary injection of morphine, ether was administered through the left nostril by catheter. After ligation of the right external carotid artery, the right superior maxillary bone, with the tumor, was extirpated. Two years after the operation this patient is perfectly well, without any signs of recurrence. He wears a plate filling in the defect, which is of great assistance to him in enunciating clearly.

BILATERAL LYMPHOSARCOMA OF THE BREASTS.

DR. C. A. McWILLIAMS presented a woman, 33 years old, who was admitted to the Presbyterian Hospital on June 13, 1911. Two weeks previously she had noticed a lump in the right breast, three and a half inches from the nipple and just to the upper and outer side of the mammary gland. The lump was the size of a large marble, and apparently was not increasing in size. There was no pain nor loss of weight. The woman was the mother of one healthy child, eight years old.

Examination showed a nodule, about the size of a hickory-nut, not tender nor cystic, in the right mammary gland, at its upper, outer quadrant. It was not adherent to the skin nor deeper parts. No axillary nodes were palpable. The remainder of the breast contained no nodules, and the opposite breast was normal.

Operation, November 7, 1911: This consisted of the removal of a bit for the frozen section examined, but as the result of this examination was not satisfactory, the wound was closed. A subsequent pathological examination of the tumor was made, and it was pronounced a benign lymphoma.

The patient returned to the hospital on November 5 with a statement that about two weeks after her discharge a small lump had developed in the right breast near the old scar, and following this, other lumps had developed in the same breast, until she now had four or five of them. About two weeks ago she noticed a lump in the left breast. All of these tumors had been steadily growing larger. There was no pain; no discharge from the nipple; no loss of weight or strength.

Examination of the right breast showed three hard, nodular masses. These were circumscribed and freely movable under the skin. There was no tenderness nor fluctuation, and the nipple was not retracted. In the right axilla there was a mass about the size of a hickory-nut. In the left breast there were two distinct masses, also freely movable under the skin, and very hard. There was no retraction of the nipple. They were situated in the upper quadrant of the breast. Nothing could be felt in the left axilla. The Wassermann reaction was negative; the spleen was normal. There were small, palpable glands in both inguinal regions. Spleen not felt.

Operation, November 7, 1911: This consisted of the complete removal of the right breast, together with both pectorals and the contents of the axilla where several large lymphatic tumors were removed. Eight days later a similar operation was done on the opposite side. Considerable shock followed the second operation, and that evening the patient's condition was poor, with dyspnoea and a weak, irregular pulse. As there was very poor response to two saline intravenous infusions, a blood transfusion was done at 9 P.M., with the result that the red blood-cells, which were 3,000,000 before the transfusion, were 3,900,000 after it. Elsberg's cannula was used with easy and good results. The patient's

FIG. 1.

Nipple and
Ducts Beneath

Large Tumor
Nodule

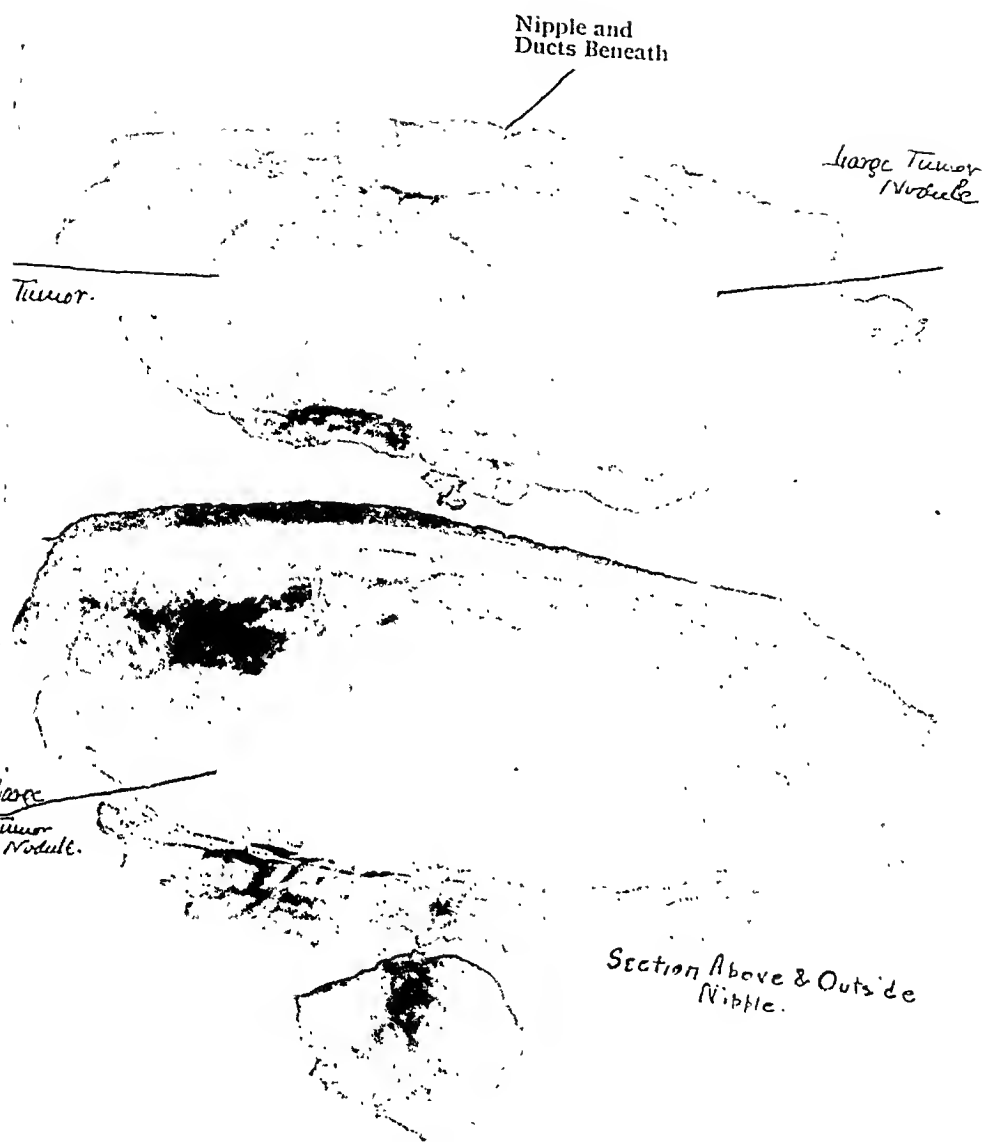
Tumor.

Large
Tumor
Nodule.

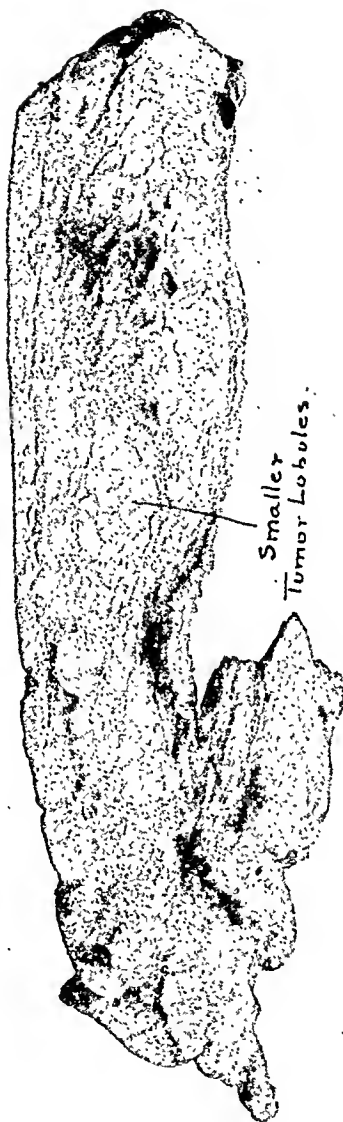
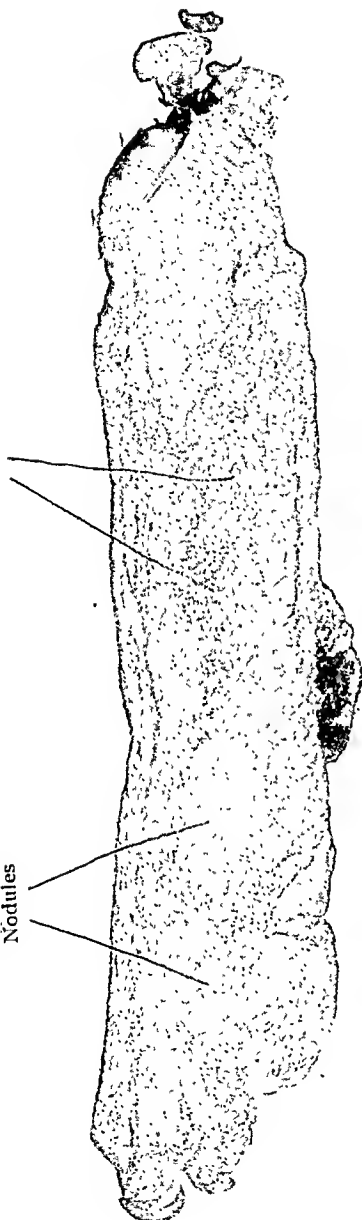
Section Above & Outside
Nipple.

0 10 20

Bilateral section of the right breast



Nodules



Smaller
Tumor Lobules

50 mm

40

30

20

10

0

Bilateral section of the left breast.

husband acted as donor without preliminary testing of the two bloods. On the following day the woman's condition was good, the pulse being strong and steady.

The pathological diagnosis in this case was lymphosarcoma of each breast, with involvement of the right axillary glands. The wounds all healed by primary union.

The subsequent course of this patient was remarkable, and showed that we had to deal with a case of acute lymphatic leukaemia, the only objective signs of the condition being the mammary tumors.

On December 3, examination of the eye grounds showed two hemorrhagic spots in the left retina on its temporal half near region of macula. On December 5, the edge of the spleen was easily felt for first time on deep inspiration. The gums of the lower jaw were swollen, spongy, tender, and with small ulcerations. The temperature was high (December 8), 105.6° , and the patient had occasional shaking chills. X-ray pictures showed no apparent enlargements of any of the lymphatic tissues. The wounds are faultless and perfectly healed.

COMPOUND FRACTURE OF THE HUMERUS, WITH SEQUESTRA: RESULT AFTER WIRING.

DR. C. A. McWILLIAMS presented a man, 32 years old, who was admitted to the Presbyterian Hospital on November 2, 1911. One month previously he had sustained a compound fracture of the left humerus, at the junction of the middle and lower third, for which he was admitted to a nearby hospital. He immediately began to run a temperature, which gradually increased, and on the fifth day he was operated upon with the diagnosis of compound fracture of the left humerus, with cellulitis. Notwithstanding the presence of infection, the fragments were wired. The incision was made over the outer side of the arm, and a transverse fracture exposed. Two holes were then drilled into each fragment, three-quarters of an inch from the line of fracture, and a silver wire introduced and twisted. A counter-opening was made on the inner side of the arm and both wounds were left wide open for drainage, rubber tubes being inserted. During the patient's stay in the hospital, from October 2 to November 1, he ran a temperature, more or less continuous, and averaging

about 102°. During the last few days in the hospital he became wildly delirious and irrational. About two weeks after the operation, the silver wire was found loose in the wound. The patient was expected to die, and he was removed to his home on November 1. When Dr. McWilliams first saw him there on that day, in consultation, the patient was apparently much prostrated, with a very dry tongue and a weak pulse, but with no temperature. He had a compound fracture of the left humerus, the opening into the bone being large enough to admit two fingers. There were several incised wounds on the forearm and on the inner side of the arm. The patient was thereupon sent to the Presbyterian Hospital, permission first being obtained to amputate the arm, should that prove necessary.

On admission, an X-ray photograph was taken, which showed that the ends of both fragments were necrotic (Fig. 4), and from these, two sequestra were removed (Fig. 3): Each sequestrum involved about an inch of the end of the fragment. The remarkable feature about them was the short period of time it took for them to separate—about one month. This also indicated how great a degree of infection there was introduced into the bones at the time of the operation. For a week after his admission, the man was very irrational and delirious. He was given large quantities of fluids, and at the end of one week he became perfectly rational. His delirium was unaccompanied by any rise of temperature. His wound was now granulating nicely, and the question which came up was, what should be done to effect a union of the fragments? There was now a defect of about two inches in the bone. Would the soft parts contract sufficiently to allow the ends of the bone to be brought together and held there by a Lane plate? If not, Dr. McWilliams said, it was his purpose to implant a bone graft taken from the man's tibia, thus filling in the gap with bone. This graft was to be placed in the medullary space of each end of the fragment. Nothing of this kind, however, could be done until all the wounds had entirely closed. On Dec. 8, the cavity between the fragments had entirely filled in and all that remained unhealed was about an inch wide of the skin surface.

FIG. 3.

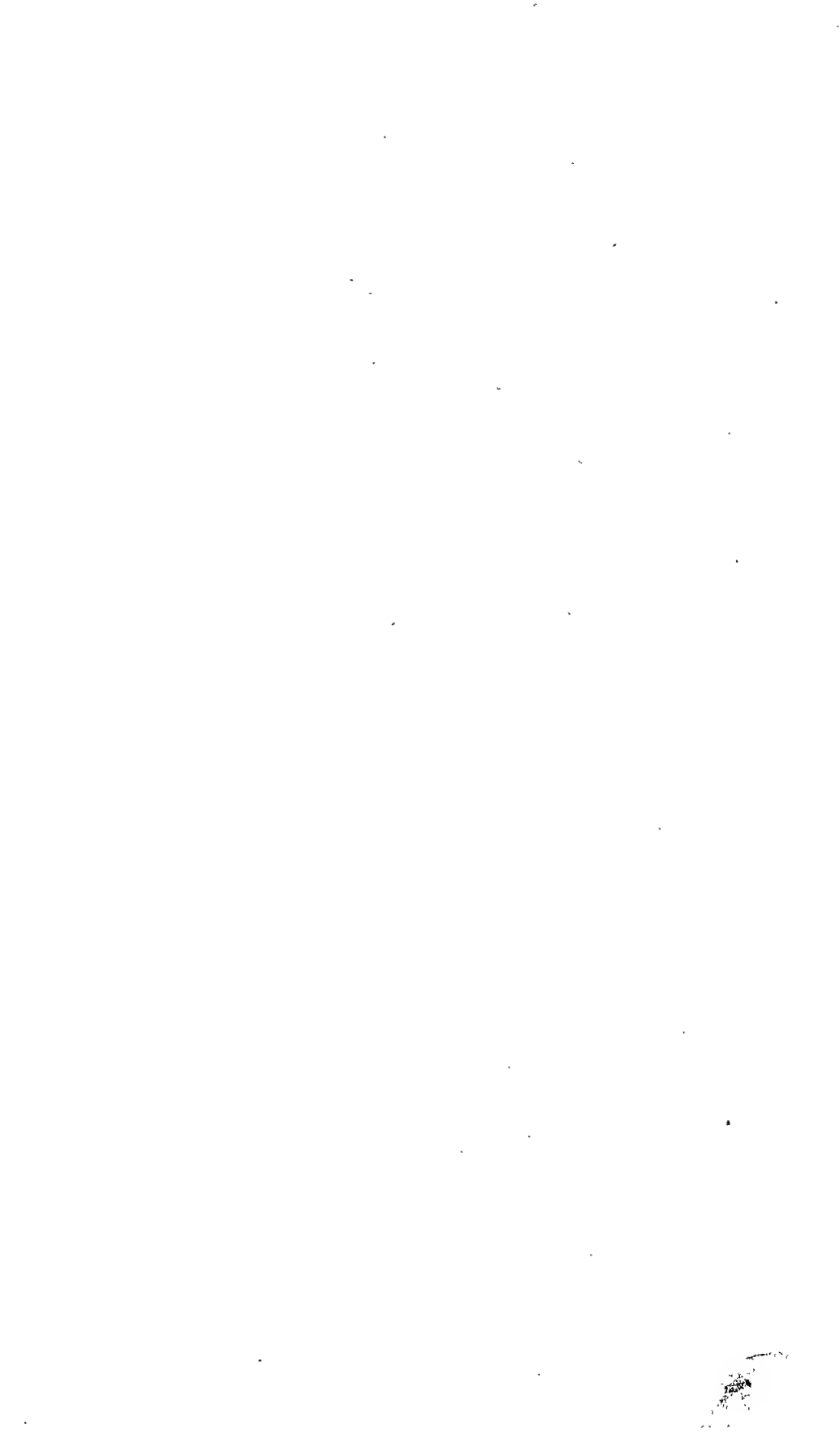


Sequestra from compound fracture of humerus

FIG. 4.



Compound fracture of humerus with necrosis of fractured ends.



RUPTURE OF THE QUADRICEPS TENDON OF THE KNEE.

DR. FORBES HAWKES presented a man, 40 years old, an engineer, who on January 26, 1911, during the excitement resulting from a fire in the building in which he was on duty, slipped from a box on which he was standing, a distance of about eighteen inches, to the floor, injuring both knees. Following the injury, he was unable to extend the left knee. There was a marked, transverse depression above the left patella, and the parts were greatly swollen and of a bluish color, suggesting a deep-seated hemorrhage. There was also some depression above the right patella, but he could extend the right knee fairly well.

The X-ray plate showed that there had been no fracture of the patellæ, but that the left quadriceps tendon, as it tore, had pulled off a few particles of bone from the upper portion of the patella.

On February 1, 1911, the left quadriceps tendon was sutured in place through a trap-door incision. It was found that it had been completely torn away from its patellar attachment, and that the lateral ligaments had been torn as well, opening the knee-joint on the inner side. The retracted tendon was easily brought down and sutured to the rough upper surface and to the periosteum of the patella with double No. 2 chromic catgut sutures. Both lateral ligaments were also sutured with chromic gut. The skin was closed without drainage, and the limb put up in extension on a moulded posterior plaster-of-Paris splint.

There was a slight reaction for twenty-four hours after the operation, but within three days the pulse rate and temperature had fallen to normal. The wound healed *per primam*. About the tenth day and daily after that the patella was moved laterally a few times. The patient was permitted to sit up in a chair, with the limb extended, and at the end of four weeks he was wearing a posterior splint during the day only, and allowing the knee full motion while in bed. A week later all support was removed and increasing motion encouraged. Motion and strength had gradually returned, but being a heavy man, he was advised to make haste slowly. He was now able to climb stairs without assistance. His left limb was a little stronger than the right.

EPIPHYSEAL FRACTURE AT LOWER END OF RADIUS;
OPERATIVE REDUCTION.

DR. FORBES HAWKES presented a boy of nine years, who on April 7, 1909, fell in the street, striking on his right hand, sustaining a silver-fork deformity of the wrist, with loss of function, and pain. The X-ray plates showed a separation of the epiphysis of the lower end of the radius. Attempts at reduction, at first without anæsthesia and later with a general anæsthetic, were unsuccessful.

On April 13, 1909, an incision was made on the dorsum of the wrist to the thumb side of the tendon of the extensor communis digitorum, which goes to the index-finger. Part of the posterior annular ligament was divided, access thus being obtained to the fractured area. It was seen that a piece of the radio-ulnar ligament and part of the lower portion of the interosseous ligament prevented reduction. By keeping these structures out of the way by means of retractors, and using a periosteal elevator as a "crow-bar," the fragment was brought into its proper position. To keep this fragment in position, it was found necessary to flex the wrist, and it was fixed in that position. The divided portion of the annular ligament was sutured with chromicized catgut and the wound closed. The hand was put up well flexed in plaster-of-Paris. Primary union resulted. The bandage was removed at the end of three weeks, when motion was encouraged. A perfect functional result followed.

At the present time, about two and a half years since the injury, there was no difference whatever in the growth of the bone. The radius presented no thickening at the epiphyseal site.

ULCER OF THE STOMACH AND OF THE DUODENUM.

DR. GEORGE WOOLSEY presented a man, 36 years old, married, a native of Scotland, and a gardener by occupation. He was admitted to the Presbyterian Hospital on July 6, 1911, at which time he was suffering from an ulcer of the stomach, situated in the lesser curvature near the pylorus. This was excised, an uneventful convalescence following.

He was readmitted Oct. 23, 1911, with the following history: For nine weeks after discharge from hospital he was in good health and gained 8 pounds. Three weeks ago, after an attack

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of diarrhoea with colic, which lasted 10 days, he began to have epigastric pain most marked above and to the left of umbilicus, coming on one and a half to two hours after eating, and relieved by taking food. There was tenderness on pressure over the site of the pain. No vomiting, but a great deal of acid eructations an hour or two after eating. Had noticed tarry stools at intervals. No mass felt.

Operation, Nov. 3, 1911, Dr. Woolsey: Posterior no-loop gastrojejunostomy. Gas and ether anæsthesia. Only slight adhesions were found between area of gastric ulcer excised and under surface of liver. Slight induration of stomach wall at this point. One-half to three-fourths inch distal to pylorus is an indurated area on postero-superior aspect of duodenum.

Diagnosis, ulcer of duodenum. Patient made an uninterrupted convalescence and was put on a Lenhartz diet. He was subsequently discharged from the hospital feeling perfectly well.

NEPHROLITHIASIS; PYELITIS; CALCULUS OF THE BLADDER.

DR. GEORGE WOOLSEY presented a man, 37 years old, who was admitted to the Presbyterian Hospital on May 29, 1911, with the history that about three years before he first saw blood in his urine. Cystoscopic examination showed the bladder to be in fair condition, showing no evidence of gonorrhœal or tuberculous cystitis. A small sore was seen in the region of the neck of the bladder. The prostate was not enlarged. The bladder was washed frequently, but in spite of this the urine occasionally showed the presence of blood.

About a year and a half ago the patient had an acute illness, with bloody urine, fever, and gastro-intestinal disturbance. His temperature rose to 106.5° and his urine was thick and yellow. During this attack he passed a cylindrical plug, white in color and hard in consistency. After this his temperature dropped immediately, but he has had similar milder attacks since. A week before admission physician told him that pus was present on catheterization of the ureters.

He had to be catheterized daily, and was able to void, with pain, only small quantities of urine. He had a slight urethral discharge, and complained of pain of moderate intensity in the right side. He ate fairly well, and his general appearance improved. On June 25, his temperature, which had been normal,

rose to 103.6° within twenty-four hours; he complained of pain in the right flank and looked acutely ill. A few days later rigidity was noted in the epigastrium and slight rigidity in the right flank. After running a septic temperature for five days his temperature dropped to normal, local signs disappeared, and the patient was able to be up and about, and was apparently gaining in strength. About July 10 he began to complain of a sudden pain in the neck of the bladder on voiding. At the same instant the flow stopped, except for a little dribbling.

On July 15 an X-ray was taken, which showed a strawberry-sized shadow in the right kidney, which Dr. Caldwell regarded as a calculus. Two days later this diagnosis was verified by Dr. Woolsey, who operated and removed a stone about the size of an almond from the pelvis of the right kidney through a posterior incision of the pelvis. It was hard and smooth. During the operation, it was noted that there were many fibrous adhesions over the pelvis. The patient made an uneventful recovery, and ten days later the urine was normal, with the exception of a considerable number of pus-cells, which had been present prior to the operation. The patient was voiding from 46 to 60 ounces of urine daily, without any obstructive symptoms, although he still complained of a dragging pain in the right flank. The symptoms indicating the presence of a vesical calculus reappeared when he was up out of bed. As there was no shadow in the bladder region in the X-ray he was again cystoscoped by Dr. Stevens, and a small stone was found. An unsuccessful attempt was made to remove this by the Bigelow evacuator, and two days later Dr. Hartwell removed the stone by perineal cystotomy. The further recovery of the patient was uneventful, and he left the hospital on August 17, 1911.

BENIGN STENOSIS OF THE PYLORUS; GASTROPTOSIS.

DR. GEORGE WOOLSEY presented a woman, 65 years old, who was transferred from the medical side of the Presbyterian Hospital on September 25, 1911. The history she gave was that for the past 20 years she had suffered from gastric distress and distention, with eructations of gas and occasional attacks of vomiting. She had also suffered from chronic constipation, with pain in the epigastric, umbilical, or right lumbar regions, often

radiating through to the back or to either shoulder. Since December 26, 1910, these attacks had become more severe, and the vomiting had become more frequent. Her symptoms usually began within an hour after eating, and the pain and distress became so severe that the patient was confined to her bed for weeks at a time. The stools were frequently tarry; the vomitus was coffee-ground at times, and on several occasions had contained particles of fruit and green vegetables ingested several days before. The patient had lost about 30 pounds in weight during the preceding eight months.

An examination after insufflation of the stomach showed that the lesser curvature was one inch above the umbilicus, and the greater curvature three inches below. There was visible peristalsis, which was evidently due to pyloric obstruction. A gastric analysis showed a total acidity of 60 c.c., with 32 c.c. of free hydrochloric acid, and an absence of lactic acid. Blood was present.

On September 25, 1911, Dr. Woolsey did a no-loop gastro-jejunoscopy and gastropexy. The pyloric ring was found to be much thickened and contracted, especially anteriorly, where there was the puckered scar of a healed ulcer. There was marked gastropexy, but no evidence of malignant disease. To prevent traction on the jejunal loop, the stomach was held up to about the level of the umbilicus by two silkworm gut sutures which were passed transversely, each suture taking three bites of the stomach wall (Rovsing's method). These sutures were removed after 10 to 14 days.

The patient made an uneventful recovery from the operation, and was discharged, cured, on August 10, 1911. Since then she has gained much in flesh and strength, she has no gastric trouble, and looks and feels like another woman. The interesting feature was the gastropexy, which was only done to avoid traction on the suture line and the danger of tearing it out. The gastropexy caused no pain or trouble while the patient was in bed or after she was up and about.

FIBROMA OF THE POPLITEAL SPACE.

DR. GEORGE WOOLSEY presented a woman, 24 years old, who was admitted to the Presbyterian Hospital on July 13, 1911, with the history that about two years before she first noticed gradually

increasing stiffness of the posterior aspect of the right knee on flexion, and about a year later she felt a mass in that region. This gradually grew larger, and nine months ago an operation was done at which only fatty tissue was said to have been removed, and which gave her no relief. There was gradually increasing pain and swelling, and the incision of the operation healed very slowly.

Examination showed a large, hard, deeply-seated, immovable mass in the right popliteal space. It was not very tender; no redness nor heat. Motion of the affected limb was limited, but not very painful, the pain being limited to the popliteal space and down the leg. An X-ray was taken, which showed no connection between the tumor and the bone.

Operation, July 13, 1911, by Dr. Woolsey: A long longitudinal incision was made through the deep fascia, disclosing the external popliteal nerve, which lay quite superficial and was displaced slightly outward. The internal popliteal nerve was much displaced posteriorly; it was separated from the vein by the tumor and lay in a deep groove in the upper end of the tumor. The latter was quite adherent to the vessels, especially to the popliteal vein, and to avoid injury to the vein, the femur was divided into three segments before its removal. It was also very adherent to the inner head of the gastrocnemius, so that a thin layer of the inner head of that muscle had to be removed with it. The tumor was about the size of a large grape-fruit. The space left after its removal was drained by two cigarette drains. With the exception of these openings the wound healed *per primam*, and the patient made an excellent recovery. A few days after the operation there was some swelling of the leg, together with a feeling of numbness and tenderness, especially along the course and distribution of the external popliteal nerve. These symptoms persisted for some time, and walking was at first painful because it necessitated the stretching of the gastrocnemius as the heel was drawn up, so that she walked on the toes. But gradually, under passive motion and massage, the heel was brought down, and she had no further trouble. Pathologically, the growth proved to be a fibroma.

SUBPHRENIC PERINEPHRITIC ABSCESS.

DR. WOOLSEY presented a boy, four years old, who was admitted to the Presbyterian Hospital on September 22, 1911, with the history that for a month prior to that time he had not been feeling well.

Examination showed a slight fulness in the right flank, and palpation gave a sense of resistance and the presence of a firm mass, about the size of an orange, which extended down about to McBurney's point. It was moderately tender, not movable nor moving with respiration, and did not fluctuate. The case was regarded as one of abscess of a high appendix, and on September 22 Dr. McWilliams and the house surgeon exposed the appendix, which was found slightly congested but practically normal in gross appearance. There was a firm, non-fluctuating mass felt as if springing from the anterior border of the liver in the anterior axillary line, and extending thence outward, downward, and to the right, where it was firmly attached to the lateral wall of the abdomen. It was apparently extraperitoneal, about four inches in diameter, and projected about an inch or more into the abdominal cavity. Its surface was smooth, with some irregularities over the lower part. The mass was regarded as a possible gumma of the liver.

At the time of the patient's admission, a blood count was made, which showed 24,800 white blood-cells, with 86 per cent. of polynuclears. Two days after the operation, the white blood-cells numbered 26,100 and the polynuclears 86 per cent. His temperature, which was 103.4° on the day following the operation, gradually fell to normal, but the abdominal distention, pain, and local tenderness in the right lumbar region were unrelieved. Wassermann reaction negative.

On September 27, Dr. Woolsey made a two-inch incision just below and parallel to the ribs, over the mass. A needle was inserted, which withdrew pus. The opening was then enlarged, and two ounces of pus evacuated. The mass proved to be a perirenal subphrenic abscess extending up to the postero-inferior border of the liver. This was drained, and the further recovery of the patient was uneventful. He left the hospital, cured, on October 27, 1911. Cultures from the pus and from the throat gave a pure culture of *Staphylococcus aureus*. The urine was practically normal.

NEPHROLITHIASIS OF THE KIDNEYS; CALCULUS IN LEFT URETER; SINUS OF LEFT KIDNEY.

DR. WOOLSEY presented a woman, 49 years old, who was admitted to the Presbyterian Hospital on July 17, 1911. She gave a history of having had mild pains in the kidney regions for 20 years prior to March, 1906, when she was operated on at Bellevue Hospital, where three stones, including a large, pipe-stem one, were removed from the right kidney. The kidney consisted of a thick shell containing several large pus pockets. Her pain persisted, and an X-ray showed stones in both kidneys. Right nephrectomy was planned, but a ureteral catheterization showed that the right kidney was apparently the better of the two. In November, 1906, the patient was again operated on, this time at the Presbyterian Hospital, where one stone, the size of an olive pit, and several smaller ones were removed from the right kidney. At this time, two small pockets of pus were opened, and the kidney was drained. On the sixth of the following month the left kidney was opened, and three or four calculi removed. This kidney was found to be much enlarged, adherent, and filled with pockets of thick, greenish-yellow, foul-smelling pus. After this operation, a sinus persisted for nearly a year. The wound on the right side had healed readily, and the patient gradually gained in strength.

Following the above operations, the patient had occasional slight attacks of pain in the right lumbar region, and eight days before her recent admission to the hospital she was seized with a sharp, severe pain over the old wound on the left side, followed by the appearance of a hard but not very tender mass. On the day of her admission, this swelling broke, and with the spontaneous evacuation of a large quantity of greenish pus, her pain ceased. An X-ray showed stones in both kidneys, more pronounced on the left side, and there was also a stone in the left ureter at the brim of the pelvis. In the middle of the left lumbar scar there was a small sinus discharging yellow pus, without urinous odor. On bimanual examination, a mass twice the size of the kidney was felt in the left upper quadrant. It could be pushed forward from behind, was firm and smooth, and not very tender. The acute onset of the painful swelling was probably due to the blocking of the left ureter by the calculus.

On July 28, 1911, Dr. Woolsey opened the old scar, evacuating three pockets of pus and partly freeing the kidney from adhesions, but these were so dense that he was unable to deliver it into the wound. The kidney was thereupon incised, and with some difficulty several phosphatic stones were removed, one the size of a robin's egg and two of bean size. The abscesses seemed to be outside of the kidney, which was very much altered and reduced to a thick shell. The wound was closed, with drainage.

The patient made a good recovery. The amount of pus in the urine gradually decreased, and under the use of urotropin, the reaction of the urine first became neutral and then acid. The wound was closing well and draining considerable urine, and the patient was able to leave for home on August 21, 1911. It is planned to remove the ureteral calculus, if necessary, at a future date.

The interesting feature of the case is that after the first three operations, all done by Dr. Woolsey, she became so well and strong that she has been able to do her housework for the past four years, though each kidney was a mere shell of a suppurating sac. Each kidney would have been removed, if the other had been healthy. The case serves to show how much may be done by conservative surgery in such cases, even when both kidneys are infected.

PERFORATING DUODENAL ULCER, COMPLICATED BY BILATERAL SUBDIAPHRAGMATIC ABSCESS.

DR. ELLSWORTH ELIOT, JR., presented a man, 44 years old, who was admitted to the Presbyterian Hospital on March 6, 1911. For the past year he had complained of indigestion, with vague sensations of pain and oppression in the epigastrium, sometimes radiating to both shoulder-blades; these pains occurred from two to four hours after meals and were relieved by taking food. He also suffered from gaseous eructations, and occasionally vomited a greenish fluid.

On the day prior to his admission he had a sudden attack of pain, severe and colicky, in the epigastric region; this radiated to the left and was persistent. There was no history of vomiting; the bowels had not moved for 48 hours, and two enemas had been given without result. Upon admission, the abdomen was found moderately distended; it was very rigid, especially in the right

upper quadrant, with generalized tenderness and tympany, except in the right flank, where dulness, as far forward as the edge of the rectus, could be elicited. A rectal examination was negative. The patient's temperature was 99.5°; pulse, 116; respirations, 24. A blood count, made on March 7, showed 7000 white blood-cells, with 88 per cent. of polymorphonuclears. The urine contained a heavy trace of albumin and many casts.

Operation: 36 hours after perforation under ether anæsthesia, the peritoneal cavity was opened through an incision parallel to the upper outer margin of the right rectus muscle, enlarged by a second incision extending at right angles to its upper extremity toward the median line. There was an immediate gush of a large quantity of turbid, dark-colored fluid, containing gastric and duodenal contents completely filling both subdiaphragmatic spaces, the space between the left lobe of the liver and the abdominal wall and the right lower half of the peritoneal cavity, together with the pelvis. The fluid was thicker, more gummous, and more offensive about the pyloroduodenal junction than at the more distant parts. A perforation in an indurated ulcer the size of a 25-cent piece was found in the anterior upper wall of the duodenum just beyond the pylorus. It was closed with a purse-string suture, reinforced by two Lemberts.

The peritoneal cavity was cleansed by general irrigation. Cigarette drains were introduced into either subdiaphragmatic space and through the suprapubic opening below into the pelvis. The abdominal incision was then rapidly closed by suture.

The patient made an excellent recovery from the anæsthesia. For a week the drainage was satisfactory. The discharge from the pubic opening was serous and the opening rapidly closed after removal of the drain on the fifth day. The discharge from the upper opening was purulent, thick, and offensive, and in this situation the sutures did not hold, the wound healing slowly by granulation. At the end of 10 days the temperature and blood count indicated pus retention, and as the patient's condition did not warrant a posterior transpleural counter-opening, the device of attaching siphon drainage to a catheter introduced into the left and right subdiaphragmatic space was adopted with excellent results. The sinuses ultimately closed. The one between the left lobe of the line and abdominal wall, which was the least deep, was the last to heal. Three months after the operation a stomach analysis

showed no hyperacidity. There has as yet been no recurrence of any ulcer symptom.

RESECTION OF INTESTINE IN STRANGULATED FEMORAL HERNIA.

DR. ELLSWORTH ELIOT, JR., presented a woman, 61 years old, who was admitted to the Presbyterian Hospital on January 15, 1911. Her family history was negative, and her past history had no bearing on her present illness, which had its onset six days before, beginning with cramps in the abdomen, with constipation, and followed by vomiting. The vomitus consisted of large quantities of bad-tasting, brownish fluid, and it occurred about once or twice daily. The patient complained of extreme thirst. Upon admission, her temperature was 98°; pulse, 112; respirations, 24. There had been no passage of either gas or fæces for six days.

Upon examination, the abdomen was found to be moderately distended, especially over its lower half. There was no visible peristalsis. In the right femoral region there was a mass about the size of a hen's egg. This was irreducible, not painful, and dull on percussion. The overlying skin was normal.

Operation: The sac of a femoral hernia, exposed through a vertical incision, was found to contain blood-stained fluid with a loop of necrotic small intestine. A second incision was then made, just above Poupart's ligament, as in the McBurney muscle-splitting operation for appendicectomy, and the loop of small intestine passing through the hernial opening quickly identified. The constriction was then relieved by division of Gimbernat's ligament from below and the liberated loop rapidly withdrawn through the intermuscular incision. A resection with end-to-end anastomosis by suture was then carried out in the usual way. In case of leakage the intestine was sutured with one catgut suture to the edge of the parietal peritoneum and the incision closed with a small rubber tissue gutter passing to a point just within the cavity.

The patient made an excellent recovery with the exception of an intestinal fistula, which developed on the fifth day and after the fifteenth day closed spontaneously. The hernial incision healed primarily.

LIGATION OF COMMON CAROTID FOR PULSATING
EXOPHTHALMOS.

DR. ELIOT presented a man, 51 years old, who was admitted to the Presbyterian Hospital on October 15, 1909. His family history was negative. The patient had been addicted to the moderate use of beer and whiskey. Over 30 years ago he had an attack of gonorrhœa. Ten years ago a piece of steel entered the right cornea, resulting in ulceration and partial loss of sight of the right eye.

Present illness: Five weeks prior to his admission to the hospital, the patient was assaulted by three men, receiving a blow over the left zygoma with some heavy instrument. After a brief period of unconsciousness, with bleeding from the mouth and nose, which was fractured, he was able to walk home. The left eye was swollen and nearly shut; this swelling gradually became less, and 17 days after the injury he had some use of the eye. Two weeks ago he first noticed that the left eyeball was protruding, and during the past week the under lid had become everted. With every beat of the heart there was a throbbing pain in the eye, and a murmur or buzzing sound could be heard distinctly in the left ear. The patient complained of pains of great intensity shooting from the left to the right side of the head. He was dizzy at times; no vomiting.

Examination showed marked exophthalmos of the left eye, which protruded to the plane of the orbital ridge and bridge of the nose. The eyelids were swollen, and between them was a red area of conjunctival tissue, one inch long and a quarter of an inch wide. On separating the lids, the conjunctiva about the iris was found to be swollen and crowded over it somewhat. The eye reacted slightly to light and accommodation. Its pulsations could be distinctly seen and felt, and a continuous blowing murmur could be heard over the entire skull and vessels of the left side of the neck; this sound was exaggerated with every heart beat, and was loudest over the left eye. An examination of the eye-ground showed marked swelling of the optic papilla, with œdema of the retina. The veins were enlarged and tortuous; the arteries small.

Operation: Ligation of the left common carotid, just above the omohyoid muscle.

There was no sign whatever of interference with the cerebral

circulation. The intracranial murmur ceased and the exophthalmos rapidly disappeared, so that at the end of ten days very little remained. At present, three years after operation, the eyesight has gradually improved and patient can use the eye in walking and in distinguishing objects at a distance. Continued use, in reading, results in headache. There is no suggestion of an inter-orbital swelling.

On November 2, 1909, when the patient was discharged from the hospital, the exophthalmos had largely receded, and the left eye was but little more prominent than the right. The swelling of the lids had disappeared, so that they were able to close over the eye, but there was still some redness and congestion. The patient was able to count fingers with the left eye at a distance of ten feet, but the sight of the eye was still much impaired. The sight was gradually improving and the pain was much less severe. The murmur heard over the cranium had disappeared. The patient still complained of slight pain in the occipital region.

DR. GIBSON showed photographs of a case where he had ligated the common carotid in 1904. In that case there had been some intracranial operation, during the course of which some trauma was inflicted, and further operative measures had to be abandoned on account of very severe hemorrhage. When Dr. Gibson first saw the patient, the eyes were bulging, and the sight of one eye was lost. He tied the common carotid, and in the course of time the patient recovered entirely, so far as the restoration of the usual appearance of the eye was concerned.

MEGACOLON.

DR. JOSEPH A. BLAKE presented a woman, aged 24 years, who was admitted to the Presbyterian Hospital January 18, 1911, and discharged March 28, 1911.

Her history before admission to the hospital was, briefly, that of chronic constipation for three years. Shortly after this commenced she had noticed a mass about the size of an egg in the left lower quadrant of the abdomen. This mass has gradually increased to its present size. Four years before admission the patient had been laid up for nine weeks with what was said to be "kidney trouble," at which time she had general anasarca.

Physical examination on admission revealed a marked bulging of the left flank. Upon palpation a mass the size of a child's head

was felt in the left lower abdomen, freely movable from side to side, but not so freely upward. The mass was not tender, and on pushing it up the uterus seemed to be elevated. On this account a presumptive diagnosis of ovarian tumor was made.

The abdomen was opened by a median suprapubic incision, and a marked enlargement of the large intestine was found confined to the descending sigmoid colon and the upper part of the rectum. The wall of the colon was much hypertrophied. The mesocolon was so long that the sigmoid could be lifted for at least fifteen inches outside the abdomen.

Considering the fact that the increase in the diameter of the colon extended well down into the rectum, it was deemed inadvisable to do an end-to-end anastomosis; so the mesocolon, having been divided and ligatured, as much of the colon was drawn from the abdomen as would at the same time permit of easy approximation of the descending colon with the rectum. These were then sutured together at their mesenteric attachments. The protruding limit of gut was then left intact in the lower angle of the wound until the remainder of the wound had been closed. Each limb was then clamped separately and divided beyond the clamps with a cautery. A tube was then introduced proximal to the clamp in the oral limb and surrounded by a purse-string suture. Thus a complete artificial anus was created, which was finally closed by cutting out the spur with an enterotribe and then closing the remaining fistula by a later operation. An examination of the specimen removed was made by Dr. A. D. Whipple, who reports as follows:

Macroscopical.—The specimen consists of part of the descending and sigmoid colon. In length it is 120 cm. (48 inches). The greatest circumference is 42.5 cm. (17 inches). In the lumen of the descending colon is an enterolith weighing 980 gm. which measures 14.5 x 10.5 x 11 cm. This fecal mass contains melon and grape seeds, beans and much amorphous detritus. The centre of the mass is almost dry.

The entire specimen shows marked thickening of the intestinal wall, most pronounced in the sigmoid portion below the enterolith. The hypertrophy of the muscular coats, particularly the inner circular, is very noticeable. The muscular coats in the sigmoid measure 3 mm. compared to the normal diameter of 1-1.5 mm. The mucosa is also thickened, measuring 1 mm. in places. In the muscular border there is a very noticeable dilatation of the vessels. The appendices epiploicæ are very large. Lymph-nodes in the mesocolon are numerous and larger than normal.

Microscopical.—The number of villi in a given area—1 sq. mm.—in different sections from the mucosa of the transverse colon appears to be fairly constant, and this number compared with the number of villi in equal areas in sections taken from two specimens of colon removed for carcinoma of the sigmoid, as well as from a normal colon, is approximately the same. An Ehrlich eye-piece with the stage micrometer was used in counting the villi.

This would indicate an increase in the number of villi commensurate with the increase in size of the entire colon.

There is some round-cell infiltration of the mucosa with enlargement of the small vessels between the villi.

As in macroscopic examination, the two muscular coats and serosa show marked hypertrophy. The lymph-nodes show simple hyperplasia.

The count of the villi is interesting, showing that the villi were increased in number so that the same number of villi existed as in a normal intestine. This places it in the category of congenital malformation of the intestine, and not a secondary enlargement.

Stated Meeting, held December 13, 1911.

The President, DR. CHARLES L. GIBSON, in the Chair

COIN LODGED IN THE ŒSOPHAGUS FOR SIX MONTHS.

DR. CHARLES L. GIBSON showed a child, 22 months old, who six months previously had suddenly developed difficulty in swallowing, the cause of the trouble not being known nor suspected. The child was admitted to the pediatric service of Dr. C. F. Collins at St. Luke's Hospital, and an X-ray was taken which showed a nickel coin lodged at the level of the fourth dorsal vertebra. The child was able to swallow fluids with moderate discomfort and nutrition was fair.

All attempts to grasp the coin by means of various modern apparatus failed, but with the coin catcher it was extracted with great ease and without any trauma. The child was now able to eat solid food without discomfort.

FRACTURE OF THE ZYGOMA.

DR. GIBSON presented a man, 22 years of age, who three weeks before operation fell against a sharp object, striking against the upper part of the cheek. The accident was followed

by immediate limitation of the movements of the lower jaw. On admission to the hospital there was pain and infiltration of the overlying tissue over the distal portion of the zygoma, and within ten days a depression of the soft parts became visible. By open incision, a V-shaped fracture of the zygoma, half an inch from the malar, was revealed, and the fractured bone was elevated into its correct position. Movements of the jaw at once became normal.

It was possible, Dr. Gibson said, that the limitation of motion of the jaw in this case might have improved in the course of time with conservative measures. Most of the recorded cases showed such a result.

MESENTERIC THROMBOSIS, WITH RESECTION OF OVER FIVE AND ONE-HALF FEET OF GUT

DR. N. W. GREEN presented a woman, 43 years old, who was admitted to St. Luke's Hospital, on the service of Dr. Robert Abbe and Dr. Walton Martin, June 19, 1911. Her family history was unimportant, and her previous history had no special bearing on her present illness. This began one week before admission, when she ate some food which gave her a diarrhoea and cramps for two days, and on one occasion, three days before admission, she passed a black stool.

At 3 A.M. on the day of her admission she was awakened with severe abdominal pain one inch to the left of the umbilicus. This pain gradually increased in severity. It remained localized in the midabdomen, with tenderness in that region. She was given some medication, which was followed by nausea and vomiting.

As the patient's symptoms indicated the presence of an intestinal obstruction, an operation was decided on. This was done by Dr. Green sixteen hours after the onset of the pain. Upon opening the peritoneum, a litre of red fluid escaped. A coil of intestine, reddish-black in appearance, was found extending transversely and slightly upward from the left iliac fossa to above the ileocæcal region. The discoloration of this coil of gut was not uniform, being lighter in some places than in others. The mesentery was red and oedematous along its intestinal attachment. Over five and a half feet of the gut was resected, and after testing the remaining portions by cutting off additional

pieces four or five inches long until free bleeding was obtained, it was anastomosed with a Murphy button, reinforced with a Lembert stitch. The mucous membrane of the excised gut was quite black. The abdominal cavity was washed out with saline solution through a Blake irrigator, and the wound closed, with drainage, to the site of the anastomosis. The diagnosis was made at the operation and was materially aided by the similarity of the picture presented on the table to that of Dr. Schley's case of last year. The pathological examination showed thrombosis of the veins in the mesentery.

The button was discharged some weeks after the operation. A sinus persisted for several weeks, but finally healed, and the patient has resumed her work.

An interesting point is that although during her convalescence she suffered from an intercurrent apical bronchitis, she has gained 35 pounds since her discharge from the hospital.

DR. WINFIELD S. SCHLEY said that some months ago, in the medical service of Dr. Theodore C. Janeway at St. Luke's Hospital, he saw a case similar to the one shown by Dr. Green, and had operated. The patient was a man who evidently had some serious intra-abdominal condition, and while no positive diagnosis was made, a laparotomy was clearly indicated and he was transferred to the First Surgical Division. Upon opening the abdomen a mesenteric thrombosis was discovered. On section of the mesentery the arteries bled but the veins were thrombosed. The abdomen was filled with bloody serum from the diapedesis of the red blood-cells. The black-red gut was excised together with several inches of healthy intestine, beyond lines of demarcation, some 22½ inches altogether being removed. An immediate end-to-end anastomosis was done. This patient made a perfect recovery. These cases of mesenteric thrombosis, Dr. Schley said, were perhaps somewhat more common than we had been led to believe. They could be divided into two groups, the acute cases and the chronic cases. The former were almost invariably fatal and were of more frequent occurrence than the chronic cases. In 214 cases collected by Jackson, Porter, and Quinby from the records of the Massachusetts General Hospital and other sources, 47 per cent. were operated on with a mortality of 92 per cent. The mortality in this acute variety is undoubtedly increased by faulty diagnosis, delayed operation,

and imperfect technic. One fatal case showed but an inch of involved gut and would almost surely have recovered with operation. The chronic cases might last for months or years and the true condition only be recognized at autopsy, or the latter might disclose a condition that had never given rise to symptoms or been suspected during life. The occlusion of a large vessel might occur without lethal termination, provided the process was very slow.

The President, DR. GIBSON, said he was rather inclined to think that this condition of mesenteric thrombosis was more frequent than we had been led to believe. Personally, he had seen four cases, two of them in his own practice. In one of the latter, the diagnosis was verified by operation and in the other by autopsy. In one of these cases, where he had made the diagnosis before opening the abdomen, in addition to the vomiting, distention and pain, there were evidences of intestinal obstruction, but the obstruction was not complete, and this he thought was a distinguishing feature in all of these cases, nor did we get the characteristic blood picture of a spreading peritonitis. In the case he had in mind, there was a practically level blood line; this and the pain in the back were very suggestive.

FIVE CASES OF GRAVES' DISEASE.

DR. JOHN ROGERS showed these cases to illustrate variations in the pathology and treatment of different forms of Graves' disease,

CASE I.—This was a Swiss seamstress, 50 years old, who gave a history of goitre existing for the past 25 years. Five or six years ago, following a strenuous period of night work and insufficient nourishment, the typical signs of Graves' disease, but without exophthalmos, began to appear, and continued with more or less interruption, apparently depending upon rest and ease or fatigue.

She first came under observation in December, 1909, and complained chiefly of dyspnœa on exertion, insomnia, vasomotor irritability, and weakness. Pulse was 110 and blood-pressure 170. There was an irregular, nodular goitre with some stridulous breathing, which indicated pressure on the trachea. These symptoms were all relieved by feeding a preparation of the adrenal proteids and enforcing more or less hygiene, but the blood-

pressure could not be reduced lower than 145. The unavoidable pressure of work and worry incident to her occupation, however, produced frequent recurrences of the signs of thyroidism, and in 1910 headache became more or less troublesome.

Therefore, on July 25, 1911, a radical operation was undertaken under nitrous oxide anæsthesia. The chief enlargement of the thyroid and the greatest pressure on the trachea seemed to be on the left side, and this lobe was removed first together with the isthmus. When it was turned out on the neck, the trachea collapsed and the imminent danger of asphyxia was avoided by pulling the trachea open with a tissue forceps attached to its most collapsed portion. It was then found that a substernal nodule on the right side had produced an S-shaped deformity of the trachea, and this part of the goitre was below the clavicle. This was then turned out by the finger introduced next to the trachea, but in lifting this part of the gland up the organ tore across in the middle of the right side. In controlling the hemorrhage, considerable more of the thyroid was sacrificed, and at the close of the operation there was left only a small nodule about an inch and a half in diameter at the upper pole of the right lobe. The trachea was sutured to the deeper muscles and fascia of the neck with catgut to keep it open. The pulse-rate had risen to 140 at the conclusion of the rather bloody operation, but at the end of two or three days all alarming symptoms had subsided, although the anæmia required some weeks to disappear. Patient left the hospital at the end of three weeks, and now is conscious of no abnormality. There is some headache, however, after fatigue, and the pulse-rate is slightly irritable but averages about 80. The blood-pressure averages 170. There seems to be a necessity of a moderate amount of feeding with the thyroid proteids to relieve the so-called fatiguability and the tendency to constipation. The headaches in these cases of manifest thyroid disease are a great puzzle, as some of them are relieved by operation and some are made worse. This first case also shows that a very small amount of thyroid tissue seems to be sufficient in older patients. It certainly is not sufficient in those who are under thirty. In other words, radical operation upon the thyroid is much better borne after middle life than before it, and more thyroid tissue can be sacrificed in age than in youth without serious consequences. It is also noticeable that this

patient, at present, does not do well on the adrenal feeding which seemed extremely beneficial before the thyroidectomy.

CASE II.—A man of 24 years, who first came under observation in June, 1910, with a very severe condition of typical exophthalmic goitre. There was pronounced exophthalmos and a large, symmetrical goitre. Pulse of 140, with a blood-pressure of 110 and great emaciation. He had been treated in the medical ward for the previous six months with the antithyroid serum, and had recovered partially from an acute toxæmic thyroidism. This followed a period of strenuous night and day work as a telegraph operator. After a couple of months of anti-serum treatment, the blood pressure would rise to 140 or 150 following each injection, and the symptoms were made worse instead of better.

Therefore, on July 13, 1910, under novocaine anæsthesia, the left superior and the right inferior thyroid vessels were ligated; and on July 22, the right superior and the left inferior were similarly treated. This was followed by considerable improvement, and in September the neck had decreased three inches in circumference but the blood-pressure was found to average 160 to 170. He was then placed upon a preparation of the adrenal proteids, as in the previous case, and immediately began to gain in all respects, and the blood-pressure slowly decreased. In July, 1911, a year after the operation, during which period he led a most hygienic mode of life with the constant administration of the adrenal proteids, the pulse-rate averaged 70 to 80, the blood-pressure was 150, the exophthalmos had disappeared, and the only abnormalities were moderate soft goitre and rather marked asthenia. This asthenia and the size of the goitre increased immediately if the feeding with the adrenal proteids was omitted for even one day. There has been a gain of 40 pounds in weight since the operation. At present the only abnormality is the moderate-sized soft goitre.

CASE III.—A married woman of 23 years, who first came under observation in December, 1910. She had suffered from typical exophthalmic goitre for five or six months. This followed a rather strenuous period during which she bore a child and did the housework for a large family of relatives. There was a large, firm, symmetrical goitre with exophthalmos, and pulse-rate of 150 and blood-pressure of 120.

On December 23, 1910, under novocaine anæsthesia, the two superior and right inferior thyroid vessels were ligated. There was a severe reaction to this operation, which was quieted by a single dose of the antithyroid serum. On January 7, 1911, the left inferior thyroid artery was ligated under local anæsthesia. This was followed by a slight-but steady improvement, and in the spring she went to Europe and was much benefited, apparently, by the change and rest. At present, the only abnormality is a somewhat irritable pulse-rate and a small soft goitre. The important point in this case is that she is now three months pregnant and shows no pathological manifestations except that she is somewhat fatiguable. This curious asthenia, so characteristic in these thyroid cases, seems to be entirely relieved by feeding with a fiftieth of a grain of the combined thyroid proteids four times a day. This third case, by the way, has gained nearly fifty pounds since the operation.

CASE IV is more recent and is a young girl of 16 years who has suffered from typical exophthalmic goitre of a severe grade for about one year. It seemed to develop after she had grown rapidly and had taken a position as a cash girl in a department store where she had very fatiguing work. She first came under observation in August, 1911, with a pronounced exophthalmos, and a large, firm goitre, which showed extreme vascularity. The pulse-rate was 150, the blood-pressure 120, and the weight was ninety pounds although she was five feet ten inches tall. There was rather noticeable brownish pigmentation of the whole body. This represents one of the severest forms of the disease.

On August 7, 1911, the left superior and right inferior thyroid vessels were tied, under local anæsthesia, and on August 14 the right superior and left inferior vessels were similarly treated. A month later on attempting to get out of bed there was a typical attack of tetany, which subsided when a fiftieth of a grain of thyroid proteids was administered every four hours. This thyroid feeding was followed by a very remarkable gain in weight of about four pounds each week. At present, she is still somewhat emaciated, but weighs 130, which is forty pounds more than when she first came under observation. She still shows some signs of thyroidism in the slight right exophthalmos and the average pulse-rate of 90 to 100.

CASE V is a farmer of 45 years, who has been sick about

eight months with typical severe Graves' disease. This seemed to follow a period of unusual strain attendant upon care for a sick wife, a large milk farm, and several mortgages. When he first came under observation in November of this year, there was moderate exophthalmos, a pulse-rate of 130 to 150, a moderate-sized firm goitre, extreme emaciation, and asthenia.

On November 21, 1911, the right superior and left inferior thyroid vessels were tied, under local anæsthesia, and on December 1 the left superior thyroid vessels were similarly treated. There was an immediate and marked improvement in the pulse-rate, nervousness, and insomnia, but a troublesome dry cough developed, which could only be relieved by feeding a fiftieth of a grain of the thyroid proteids every four hours. There has been a gain of two or three pounds in weight each week, and the pulse-rate is now between 70 and 80 regularly, and hence it seems that it will be unnecessary to tie the remaining inferior thyroid vessel. If, however, any signs of relapse develop, the right inferior thyroid artery will be immediately tied.

The adrenal proteids referred to above are prepared in the same way as are the active ingredients from the thyroid gland. That is, the respective organs, generally the beef adrenals or the sheep thyroids, are hashed and suspended in salt solution for twenty-four hours, and the coarser particles are strained out through sterile filters, and the filtrate at a temperature of 40° to 50° C. treated with dilute acetic acid. The precipitate thus obtained represents the thyroid or adrenal proteids. In the case of the thyroid the proteids are standardized at the Loomis Laboratory according to their iodine content. The adrenal proteids are not standardized, but being treated in the same way each time are presumably closely alike in each preparation. They do not contain epinephrin, but a vasodilator instead of a vasoconstrictor substance.

The most obvious facts in these cases are their apparent origin in some fatigue process, and hence the presumable fatigue of the thyroid. This induces in the gland some alteration in its biochemical relationship with iodine which causes variations in both the quantity and quality of its secretion. The first requisite is to obtain rest for the thyroid, and this seems most safely and properly brought about by cutting off its blood and nerve supply. No more than two of the vessels, however,

can be tied at one sitting without considerable risk. The upper and lower vessels on opposite sides have been selected in these and other cases for operation, to avoid risk of paralyzing the phrenic, pneumogastric, and sympathetic nerves by the local anæsthesia. If both lower vessels were ligated at the same time, there is considerable risk of paralyzing the phrenics by the novocaine.

The inferior artery is reached by a two-inch incision along the outer border of the lower end of the sternomastoid muscle. The outer edge of the jugular vein is exposed, avoiding or cutting if necessary the external jugular, then the fascia at the outer edge of the external jugular is cut through, and the great vessels turned forward. By a little blunt dissection the inferior thyroid artery is found in the deep parts of the neck about one finger's breadth above the inner end of the clavicle, and tied where it passes transversely behind the common carotid. The inferior artery, by the way, is ligated with less pain than the superior, which has to be exposed by drawing aside the hyoid muscles. It is important in all these cases to excise the top of the thyroid lobes together with the vessels in order to cut all the blood supply. The superior thyroid vessels generally subdivide into several branches just before entering the gland, and it is quite easy to overlook one of these subdivisions unless half an inch of the top of the thyroid lobes is cut away. This excision of the top of the thyroid lobe gives much comfort to the patient subsequently, as without it there is considerable pain in swallowing for several days.

As evidenced by the necessity for adrenal feeding, and the very apparent benefit in certain cases, noticeably all those which have a blood-pressure of 140 and above, it seems probable that with the presumable fatigue of the thyroid there is a fatigue in the adrenal gland, which is known to be closely associated in its functional activity with the thyroid. The feeding with the adrenal as with the thyroid proteids is for the purpose of relieving the strain upon these organs, and by supplying a defect in the organism the nutrition is improved.

The surgeon's duty to these cases by no means ends with the operative interference, but they must be closely supervised for from six months to two or three years, during which time hygiene in the form of avoidance of fatigue and yet with the provision of sufficient exercise to maintain nutrition must be provided. In

addition, thyroid feeding below the point where it activates the thyroid itself can, in the majority of cases, be continued. Those which have a high blood-pressure cannot be benefited by thyroid feeding, but will be greatly helped by feeding with the adrenal proteids.

More extended reference to these preparations and the theories of treatment can be found in the *Journal of the American Medical Association* for September 2, 1911.

These cases, Dr. Rogers said, showed the results which could be obtained with suitable and cautious treatment. Graves' disease, with symmetrical goitre, could not be as safely and permanently relieved by partial thyroidectomy as by ligation of two or more vessels. The cases with asymmetrical goitres generally must have partial thyroidectomy performed, or at least enucleation of the diseased thyroid tissue. It was important to sacrifice as little as possible of the comparatively sound gland.

PARTIAL ENTEROCOLECTOMY FOR RECURRENT CARCINOMA, WITH REPAIR OF VENTRAL HERNIA.

DR. WALTON MARTIN presented a woman, 51 years old, who was admitted to St. Luke's Hospital, in the service of Dr. Samuel W. Lambert, on September 27, 1911. The history she gave was that in May, 1894, she was operated on by Dr. Paul Outerbridge at the General Memorial Hospital for a carcinoma of the transverse colon. The transverse colon, with the tumor, was resected, the divided gut being joined by a silver Murphy button. The hospital records stated that the tumor was as large as a fist, but there was no report of the microscopic finding. Dr. Outerbridge himself remembered the case, and believed that the growth was a carcinoma.

The patient made a good recovery, regaining her strength and normal weight. In a few years, however, she noticed a protrusion in the laparotomy scar. This gradually increased until it assumed very large proportions. She remained in good health, however, until two or three years ago, when she began to suffer from abdominal distention and gradually increasing constipation. She attributed these symptoms to her ventral hernia, but in May, 1911, she began to lose weight and strength and was obliged to give up her work. She was then admitted to Bellevue Hospital,

where she was told that she had tuberculosis, and tubercle bacilli were said to have been found in her sputum. While in bed, she discovered a movable, hard tumor in her abdomen. She left the hospital somewhat improved last summer, and in the autumn, as she was still weak and ill, she was admitted to the medical service at St. Luke's Hospital.

Examination at that time showed a fairly well-nourished woman. There was slight dulness at the apices of her lungs, and the aortic second sound of the heart was accentuated. The abdomen was lax and pendulous. There was a median scar from the xiphoid to just above the pubes, and in the middle portion of this scar was an opening through which a large mass protruded. This could be readily reduced. A firm, movable, slightly tender mass could be easily palpated in the right half of the abdomen. The patient's temperature was normal. The urine had a specific gravity of 1012 and contained a trace of albumin. Repeated examinations failed to show tubercle bacilli in the sputum, nor was there any cough.

After the woman had been under observation for several weeks, she was transferred to the surgical division for operation. On September 27, 1911, under ether, the old laparotomy scar, with the hernial sac, was excised, and the abdominal cavity opened. The ascending colon had a mesentery, and was freely movable. At the cæcal junction was a hard mass involving adjacent portions of the ileum and cæcum, and there were adhesions between the coils of the lower portion of the ileum. About ten inches of the ileum and four inches of the ascending colon, together with the adjacent portion of the mesentery, were removed. The divided ends of the gut were united by lateral anastomosis, a double layer of sutures being used for the purpose. The hernia was then repaired by lateral overlapping. After the overlapping of the muscles and fascia, the lax and pendulous skin was found to be redundant, and a semi-ellipse of skin was removed from each side of the lower quarter of the incision. The skin was sutured in the median line to this point, and then transversely, leaving an inverted T-shaped scar.

The section of the gut removed consisted of the lower 40 cm. of the ileum and the first 11 cm. of the colon, together with the appendix and the mesentery. In the cæcum and invading the end of the ileum was a hard tumor, 5 x 5 x 4 cm., white and

gritty on section. Its inner surface was ulcerated. Microscopically, it proved to be a gelatinous carcinoma.

The patient made an uneventful recovery from the operation. For several weeks afterward, however, she suffered from diarrhœa, having seven or eight movements daily. At present, these had been reduced to two or three.

Dr. Martin said the case seemed to be interesting on account of the possibility that the original growth, removed 17 years ago by Dr. Outerbridge, was a carcinoma, and that a recurrence had taken place in another portion of the intestine; also, on account of the considerable sections of the gut that had been removed, 18 inches being removed at the first and 20 inches at the second operation. The diarrhœa was presumably due to the interference with absorption in the cæcum and colon.

Dr. LILIENTHAL said that a number of years ago he showed a patient at one of the meetings of the Society where he had removed an adenocarcinoma of the hepatic flexure, followed by an enterocolostomy. For nine years that patient remained perfectly well, and then developed an inoperable carcinoma of the rectum.

It was probable, Dr. Lilienthal thought, that adenomata were of more common occurrence in the large intestine than we supposed, and that they frequently escaped attention until carcinomatous changes supervened, and this had led him to the conclusion that in dealing with an adenoma or tumor of any size involving the large intestine, he would in future make a careful exploration of the entire colon.

RUPTURE OF THE URETER, FOLLOWED BY EXTRAVASATION
OF URINE AND SUPPURATIVE NEPHRITIS;
NEPHRECTOMY.

Dr. WALTON MARTIN presented a boy, eight years old, who was admitted to St. Luke's Hospital on May 8, 1911, in the service of Dr. Robert Abbe.

The history obtained was that six weeks previously he had been run over by an ice wagon, both wheels passing over the patient, who was lying on his stomach. He suffered from shock, but was not unconscious. Immediately after the accident, he vomited several times, and complained of pain in his back and lower abdomen. He was taken to the Harlem Hospital,

remaining there for several hours, and was then removed to his home. During the next two or three days he continued to vomit from time to time, and complained of pain in the loins. No blood was noticed in his urine, nor was any observation made of the amount of urine passed. Subsequent to this he improved somewhat and was up and about, but he still complained of pain in the lumbar region and had occasional attacks of vomiting. About a week before his admission to the hospital his mother noticed a large swelling in the left side of his abdomen.

Examination on admission showed a rather pale and poorly nourished boy. On the left side of the abdomen, from the free border of the ribs to Poupart's ligament, there was a smooth, slightly tender swelling, elastic and tense, over which a fluid wave could be plainly demonstrated. The examination was otherwise negative. The pulse-rate was 116; respirations, 20. The urine was negative. On the day of his admission, he passed fifteen ounces and on the following day nine ounces.

On May 12, 1911, under ether anæsthesia, the abdomen was opened by Dr. Abbe through a seven-inch incision along the left border of the rectus. A cystic mass, about the size of a football, was found. It was beneath the peritoneum and in the neighborhood of the left kidney. On puncture, a clear, odorless fluid was withdrawn. Two large drainage tubes were introduced into the cystic cavity, and gauze packed about the tubes. The abdominal wound was then closed.

On the following morning there was a urinous odor to the discharge from the wound, and from this time until August 7 the boy continued to drain urine from his abdominal wound. His temperature on the fourth day after the operation was 103° F., and he continued with an irregular fever; occasionally, he had a slight chill, followed by a sharp rise in temperature; he looked septic and lost weight.

On August 7, under ether anæsthesia, the left kidney was removed through a transverse incision. The kidney was slightly larger than normal, measuring 9 x 5 x 4 cm. The pelvis was smooth, pale, and apparently thickened. At the junction of the pelvis with the ureter there was dense scar tissue, and a sinus passed from this point to the incision of the previous operation.

Microscopical examination showed areas of kidney tissue infiltrated with pus, blood, and round cells; the tubules were

widely separated by an exudate; some were destroyed; the lumen of others was filled with pus and necrotic material. The boy made an uneventful recovery, and left the hospital at the end of seven weeks with the wound healed and the abdominal sinus closed.

Dr. Martin said there were but few cases of ruptured ureter reported. The late Dr. F. Tilden Brown, on October 12, 1904, presented a patient with a history almost exactly similar at a meeting of this Society.

Blauel in an article in the *Beiträge zur klinischen chirurgie*, in June, 1906, based his observations on twelve cases reported up to that time.

DR. L. W. HOTCHKISS, in connection with Dr. Lyle's case, said that in August, 1908, at Roosevelt Hospital, he had operated upon a negro who was brought in with a penetrating shot wound of the abdomen. Laparotomy was performed and it was found that the bullet had perforated both walls of the stomach and lodged in the back. These wounds were sutured and the abdomen closed. About two weeks later an abscess had developed in the left groin, and upon incision this was found to contain much urine, which made it clear that there was a wound of the left ureter. Operation, September 16, three weeks after injury, revealed the ureter completely divided by bullet and its distal end buried in scar tissue and with considerable loss of substance, so that it was impossible to do an anastomosis. The left kidney was therefore removed, and the patient made a good recovery. Shot wound of the ureter, Dr. Hotchkiss said, was an exceedingly rare occurrence.

EXTENSIVE EPITHELIOMA OF THE CHEEK, WITH SECONDARY INVOLVEMENT OF THE GENIAL GLANDS.

DR. HENRY H. M. LYLE presented a man, 52 years old, who was admitted to St. Luke's Hospital in September, 1910. He had a tumor of the left cheek, of eleven weeks' duration. Ten days previously his physician had incised the tumor, but no pus was found.

On examination, there was a large, indurated swelling occupying the left cheek and involving the angle of the mouth. In

the centre of the mass there was a discharging sinus. The buccal surface showed a cauliflower-like growth, which was not attached to the jaw. The submaxillary lymphatics were enlarged and hard. A section of the growth, removed for examination, showed it to be a squamous-celled carcinoma.

Operation: A wide excision of the growth, including the angle of the mouth, was made, and the defect closed by a modification of the Dowd operation, plus a flap taken from the neck. Primary union resulted. Ten days previously a block dissection of the neck and submaxillary and submental regions had been done.

Four months later, when the patient returned for observation, an examination showed that the mucoperiosteum of the jaw had become involved, and there were two distinct hard nodules on the cheek, one just below the centre of the malar bone; the second an inch lower down and posterior to the angle of the mouth. There was no cervical involvement.

At a second operation, virtually the whole cheek below the malar bone was removed, along with the fascia and fat covering the masseter. In this fascia, the buccinator and maxillary groups of the genial glands were found to be involved. The left half of the body of the jaw, with the involved mucous membrane of the floor of the mouth, was removed. Cutaneous flaps were obtained from the neck and the right side of the chin. Considerable difficulty was experienced, owing to the cicatricial tissue left from the previous operation. The buccal lining of these flaps was obtained by splitting the mucous membrane of the tongue and turning it upward, after the method suggested by Sonnenburg.

Three months ago a secondary plastic operation was performed to widen the cavity of the mouth, with good cosmetic and functional results.

Dr. Lyle said the points of interest in the case were: (1) the involvement of the genial glands, failure to recognize and remove these at the time of the primary operation having been the cause of the recurrence: (2) the use of a flap of mucous membrane from the tongue to line the cheek.

TREATMENT OF SIMPLE FRACTURES: SOME END RESULTS.

DR. JAMES H. HITZROT read a paper with the above title, for which see page 338.

In connection with his paper, Dr. Hitzrot showed a number of patients and stereopticon illustrations.

DR. GEORGE WOOLSEY said the worst cases he had observed were in transverse fractures of the long bones, especially the femur, in adults. In the cases of this type of fracture shown by Dr. Hitzrot, the reduction of the fracture was apparently excellent. But most of these were in children. In muscular adults it was by no means as easy, and in these cases, if complete reduction cannot be secured under anaesthesia, early operation, reduction, and plating are strongly indicated. Traction is inadequate in such cases if there is any overlapping. The speaker recalled two such cases in the femur in the last few years, treated by extension with a bad result, non-union, and much shortening. Open operation was required, and under such circumstances is far more difficult than in recent fractures.

DR. HITZROT, in closing the discussion, referring to transverse fractures, said he did not think that the direction of the fracture made as much difference as the time at which the attempt was made to reduce it. Those cases that were allowed to go untreated for three or four days were the ones that gave the most trouble, and if extension did not bring about the desired result within a week, it was impossible to reduce them by other non-operative means. These neglected cases were the ones that demanded early operation.

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227-231 South Sixth Street,
Philadelphia.

PREVALENT DISEASES.

Each change of season brings with it its diseases seemingly peculiar to the time.

Summer with its Intestinal Disorders, Sunburn, Insect bites, Ivy Poisoning, etc.

Fall presents for the attention of the physician, its Typhoid cases and Winter and early Spring, its regular quota of Pneumonic, Bronchial, Throat and other chest conditions.

At this season, when Pneumonia and Bronchitis demand the call of the Physician, literature presenting the experience of fellow practitioners, in the successful handling of these cases, would seem most apropos.

The Bloodless Phlebotomist for January reflect the experience of many physicians upon this timely subject.

Dr. Charles Buck, of Cincinnati, presents his experience in handling cases of Pneumonia, also relates some facts in the treatment of Lumbago, which might also be considered as an affliction prominently manifesting itself at this season.

"Broncho-Pneumonia" with supportive as well as local treatment in all its details, is the subject of the paper of F. A. Kautz, also of Cincinnati.

Dr. E. Clinton Murray, of Houston, Texas, relates his experience and treatment in a case of Pneumonia in an eighteen months old baby, and Dr. J. C. Klippinger, of Independence, Kansas, presents "Different Technique in Pneumonia," which is decidedly original. In abstract his method is to apply the local dressing in a manner which gives the intercostal muscles a chance to functionate without restriction from bandages. This symposium is closed with a paper from Dr. W. A. Radue, of Union Hill, N. J., upon "Acute Pleurisy and a Successful Abortive Treatment."

Besides the papers referred to upon the subject of Chest and Throat diseases, much additional information is given. The one in particular we would have you note is the "Rational Influence of Hot Applications," by that well-known therapist, Dr. Finley Ellingwood, of Chicago, Ill.

A postal card addressed to the Bloodless Phlebotomist, No. 57 Laight Street, New York, will bring you a copy of the January issue.

A FINE LINE OF STERILIZED SOLUTIONS.

Hermetically sealed glass ampoules containing sterilized solutions of important drugs for hypodermic use have assumed a commanding place in medicine in a comparatively short period of time. Two or three years ago, seeing the tendency in this direction, Parke, Davis & Co. brought out a modest line of something like a half-dozen formulas, notable among them being solutions of Adrenalin, Codrenin, and Cacodylate of Sodium. From this small beginning the line has expanded until now the company announces a total of about twenty distinct formulas. The full list, we understand, is now appearing in display advertisements in the leading medical journals of the country. Physicians who are interested in this advance in hypodermic medication—and every physician ought to be—will do well to search out these advertisements and familiarize themselves with the comprehensive line of solutions therein offered.

Solutions provided by the glaseptic ampoule, it is obvious, have several advantages over those prepared in the ordinary manner. They are ready for immediate use: there is no necessity to wait until water can be sterilized and cooled. Accuracy of dose is ensured, each ampoule containing a definite quantity of medicament. The solutions are aseptic; they are permanent.

CAUTION

THE ILLY NURTURED BABY

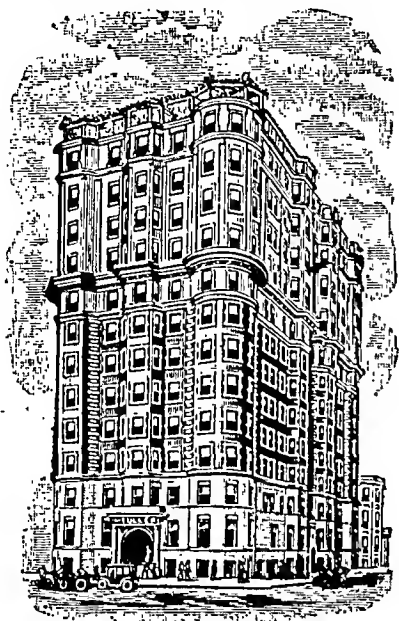
In the course of daily practice the physician is frequently called upon for advice as to the management and treatment of the child that fails to thrive. Many such babies, while not marantic, and while apparently happy and healthy in other respects, seem to remain "in statu quo," without evidencing the normal growth and gain in size and weight. Very naturally, the first thing to be investigated is the character of the child's food, the frequency of feeding, etc., and attention to the food factor is imperative, if improvement is to be expected. In addition to this, however, the little patient often requires some "fillip" to vitality, in the form of a mild general tonic and reconstructive. For this purpose nothing is more generally beneficial than Pepto-Mangan (Gude), in doses proportionate to age. Being palatable, even young children take it readily. As it is free from irritant properties, it is readily tolerable and absorbable, without disturbing the digestion or producing constipation.

The value of heat as a therapeutic agent has been so conclusively proven that it will admit of no further argument.

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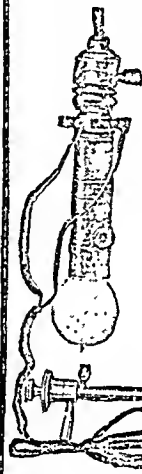
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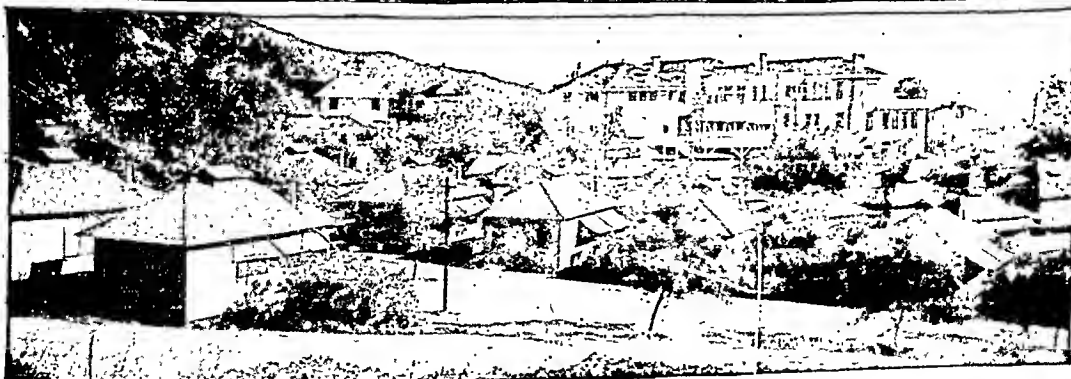
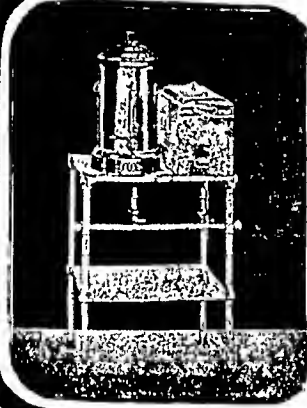
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TREATMENT OF TYPHOID WITH PYRAMIDON.

Pyramidon is similar to antipyrine as a nerve tonic and antipyretic, but is about three times as strong. In febrile conditions, it also stimulates the metabolic activity of the cells. According to Vinay, *Lyon Medical*, 1908, No. 47, Pyramidon does not depress the heart or circulation, or disturb the stomach; while at the same time intestinal putrefaction is restricted. A dose of 0.2 to 0.3 gm. is usually sufficient to bring down the temperature 2 to 2.50°. After 1 to 1½ hours a profuse perspiration will usually set in. In a number of cases, polyuria was also observed.

A very beneficial effect is seen in typhoid, where the headache, delirium, and insomnia will rapidly disappear. Pyramidon, the author claims, is to be preferred to antifebrin and phenacetin, as it is more powerful, and less dangerous. Many clinicians of the present day prefer Pyramidon to bathing.

When the stomach is rebellious, the drug may be given per rectum, in the form of suppositories. The proper dose in typhoid fever is 0.25 to 0.3 gm. every three hours, according to the height of the temperature. Exactly 257 cases of typhoid treated with Pyramidon could be collected from the literature, with a mortality of but 4.67 per cent.

A PROMISING AGENT IN HAY FEVER

Dr. J. E. Alberts, of The Hague, Holland, undoubtedly performed an important service when he directed the attention of the medical profession to his new combination for the treatment of vasomotor rhinitis. We refer to the combination now known as Anesthone Cream, which has heretofore been briefly noticed in these pages, and which contains one part of adrenalin chloride to twenty thousand (1:20,000), and ten per cent. of para-amido-ethyl-benzoate, and is marketed in the form of an ointment.

Applied to the mucous membrane of the nares, Anesthone Cream has a persistent anesthetic effect which affords marked relief in hay fever. As para-amido-ethyl-benzoate is only slightly soluble in aqueous fluids, its anesthetic action is prolonged. It does not have the poisonous effect of cocaine upon the protoplasmic element of cells, nor does it depress the heart. Furthermore, there is no tendency to "habit" acquirement.

The preparation came into considerable use during the hay-fever season of last year, the consensus of opinion being that it affords a very practical and satisfactory means of relief from symptoms due to hyperesthesia of the nasal mucous membrane, and without

ill effects—an important consideration. The fact that the relief continues for several hours in some cases is worth remembering, in view of the fleeting effect of most local anesthetics.

Anesthone Cream is supplied in a collapsible tube with an elongated nozzle to facilitate its application to the nasal mucosa, a portion of the cream about the size of a pea being applied three or four times a day, as may be necessary. It is marketed by Parke, Davis & Co. Whether, as an agent in the treatment of hay fever, it will attain the vogue reached by some other preparations put out by the same company—notably Adrenalin Chloride Solution and Adrenalin Inhalant, which have been before the medical profession for a number of years and thus have the advantage which pertains to priority—remains to be seen. At any rate it is worthy of a fair chance, which, of course, in the long run it is certain to get.

THE POMEROY MATERNITY CORSET

The Pomeroy Maternity Corset is made for a specific purpose, and its one ultimate aim and object is to give comfort and ease to the wearer. It is essentially the work of the specialist, and hygienic principles are employed from the construction of the models down to the last finishing touch in the garment.

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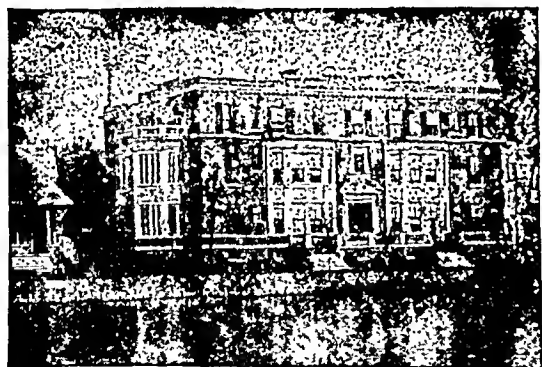
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is especially valuable when there is torpidity of the bowels or intestinal sluggishness arising from organic derangement of the liver and kidneys. It is the best agent for the relief of that form of costiveness that is ushered in by an attack of colic and indigestion, and not only clears away the effete and irritating matter in the alimentary tract but eliminates the semi-inspissated bile that too frequently induces the so-called "bilious" condition; at the same time an abundant secretion of normal bile is assured, thereby demonstrating its value as a liver stimulant and true chologogue.

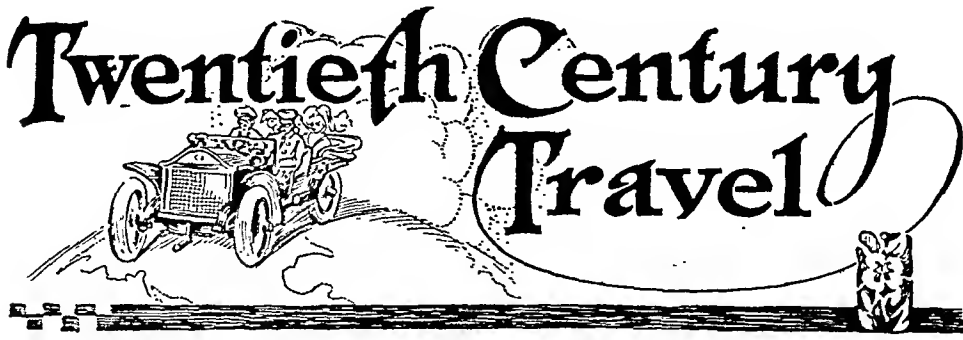
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SIGNS OF SPRING

By Minna Irving

THE frost is on the window-pane,
 The snow is at the door,
 And like a lion round the house
 I hear the norther roar.
 The icicles along the eaves
 Are hanging by the yard,
 The mercury is going down,
 The pipes are frozen hard.

But though I hug the glowing grate,
 I know that spring is near,
 With opening buds and singing birds,
 And balmy atmosphere,
 And swinging-holes in shady nooks.
 To tempt the country lads,
 For lo! the monthly magazines
 Are full of auto ads.

THE SMALL GARAGE

By Churchill Williams

THE majority of automobile owners keep their cars in a public garage. The minimum charge of such garages in towns and cities of any size is probably fifteen dollars a month for each car; the maximum, thirty dollars, or even more if pressure for accommodations in that particular neighborhood is heavy. This means an average annual expenditure by the automobilist of about two hundred and fifty dollars. For that amount of money his car is kept in what is supposed to be—but often is not—a dry, well-ventilated and, in cold weather, sufficiently heated place; also that it is washed and its brass work polished daily. If these conditions are fulfilled, the charge for the service is not unreasonable, in view of the expenses and hazards of the business. But frequently the public garage is not the best place in which to keep a fine car; and still more frequently it offers excellent opportunity for use and abuse of the car by irresponsible persons,

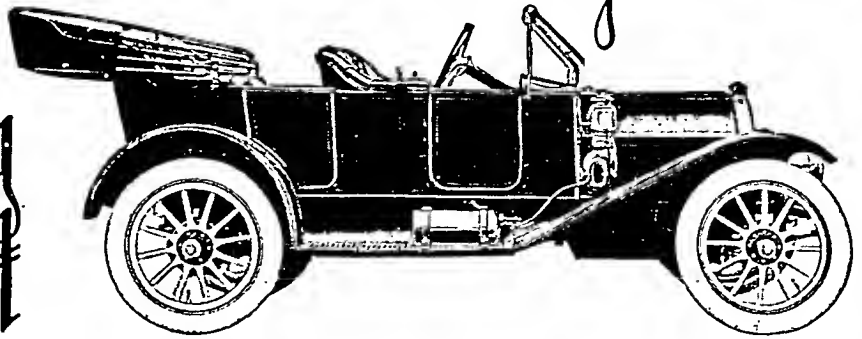
usually employees. A heavy percentage of the thefts and wreckage of automobiles, with resulting damage suits, refers to those kept in public garages, and apparently the most that scrupulous watch and strict discipline by the management can accomplish is to reduce the chances of unauthorized use of the cars in its charge. Under such circumstances, the public garage does not strongly recommend itself to the man able to provide quarters of his own.

This, however, explains only in part the rapid increase in the number of small privately-owned garages. If a chauffeur be employed the greater convenience of having the car under one's windows, as it were, handy for personal inspection, ready for immediate use, makes it worth while to have accommodation for it on the home grounds, if only there be space sufficient for the building and for a driveway to the street.

When the owner runs his own car, its

Service — is — Quality In-Built

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¶ All that you can ask of a motor car is **good service**. ¶ Service is quality in-built.

¶ You can not reasonably expect good service from a car whose chief merit is its price, nor from a motor car hastily thrown together from materials none too closely inspected and tested, nor from a car whose splendid finish covers a multitude of mechanical sins. That kind of car keeps your pocketbook slim.

¶ An automobile should be an investment in economy. In buying then you must consider the cost of maintenance; some cars, as you know, pile up repair bills in a single season that fairly equal the purchase price of the machine. ¶ With the **Paige**, the **first cost is practically last cost**. The Paige is built for your needs. It is a **quality** car in every nut and bolt—every rod and gear.

¶ The chief merit of the Paige is in the quality of the materials assembled by workmen of quality in a factory where the old fashioned idea of doing things right, if they are to be done at all, prevails from the experimental room to the shipping room.

¶ There are motor cars cheaper than the Paige, but under present conditions it is impossible to build a better motor car for less than \$1,000. At that, there is **25 per cent. more motor car value in the Paige at \$975 than in most cars selling up to \$1,400**. We make this statement only because hundreds of owners have made the same statement of their own accord.

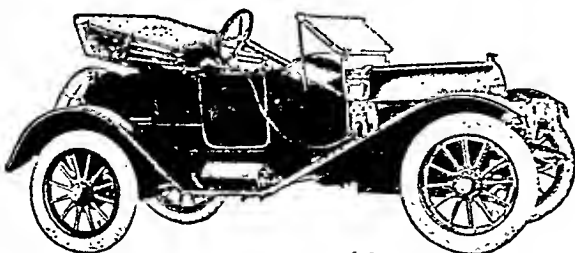
¶ Make a comparison for yourself. If you do, we have no doubt of your eventually buying a Paige.

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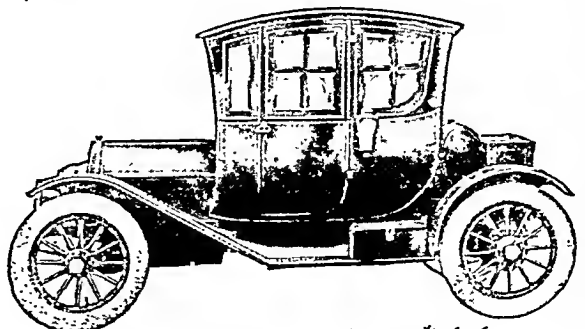
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The Small Garage

housing on the home grounds is even more desirable. But in this case there are likewise possible disadvantages. Washing the car and polishing brass, by no stretch of imagination, can be regarded as agreeable work. And so, when the first burst of enthusiasm is past, there is the temptation to shirk this work, with the result that the car suffers in appearance and in well-being. Also there is the fact that, in the home garage, there is no mechanic at hand to solve those puzzling performances in which the best of automobiles occasionally will indulge. In short, unless some one be engaged to keep the car clean, and the car itself be run to the nearest repair shop whenever it seems to require adjustment, it is strictly up to the owner to be his own man and his own "doctor." But, for many of us, the working out of small mechanical difficulties, the adjustment of operating parts, so that each shall function properly, is only second in the satisfaction it affords to that derived from the skilful running of the car on the road. And as for the washing and brass polishing—it is possible to accept these in a spirit of resignation, sweetened with the thought that, by so doing, the car has escaped attack from those rubber-and-paint-destroying preparations which, under the name of soap, are used in certain public garages, that it has not been left standing for any length of time in puddles of oil, diluted kerosene or water, that the more easily-damaged portions of its equipment do not suffer at the ruthless hands of some ignorant "washer," and that the hazard from fire and the risk of damage from collision with a neighboring car have been reduced to the minimum.

So, if only the owner can give the time and will give the patience and personal attention necessary to keep

the car in his own garage up to the mark in appearance and mechanical efficiency—a job quite within the capacity of almost anyone qualified to handle the steering wheel—then, the net results will be all in his favor as compared with those secured by his neighbor who resorts to a public garage. It is for the information of such a man, and particularly for him whose ownership of an automobile depends upon cutting costs to the limit, that the following suggestions are offered.

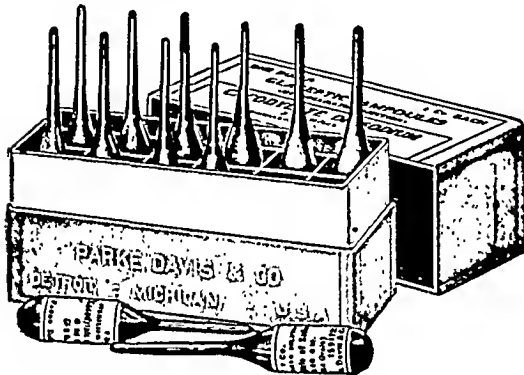
Of first consideration in planning the small garage is the driveway to the street. This is particularly so in the case of the suburban or small country place where space is relatively restricted. If the driveway in such instances be not carefully laid out beforehand it may be found, after the garage is up, that insufficient allowance has been made for a comfortable approach to the building and that, in consequence, the car is brought in or out only with difficulty, and with possible injury to itself or to the bordering lawn or flower beds. Perhaps the surest way to avoid this mistake is to remove a panel of the street fence at the point determined on for an exit, and run the car through this opening and over the turf along what seems to be the most desirable line to a point immediately opposite where it is intended to locate the garage. If, along this line at some convenient place, there be not room for a circle or a Y extension to permit of the car being turned around, then the car should be backed out to the street again along the same general line followed in bringing it in. One foot of allowance on either side of the wheel-marks so made in the turf will give a driveway of barely sufficient breadth, and special care should be taken to add to this width where it

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No.

1. **Adrenalin Chloride Solution, R 1** (1:10,000). 1 Cc. ampoules.
2. **Adrenalin Chloride Solution, R 2** (1:1000). 1 Cc. ampoules.
3. **Caffeine and Sodium Benzoate, 0.5 Gm.** ($7\frac{1}{2}$ grains): Equivalent to 0.25 Gm. ($3\frac{3}{4}$ grains) Caffeine and an equal amount of Sodium Benzoate. 2 Cc. ampoules.
4. **Camphor in Oil, 0.2 Gm.** (3 grains). 2 Cc. ampoules.



5. **Codrenin, R "C": Adrenalin Chloride,** 0.0001 Gm. (1:10,000); Cocaine Hydrochloride, 0.0025 Gm. ($\frac{1}{4}$ of 1%). 1 Cc. ampoules.

Ergot Aseptic (equivalent to 30 grains Ergot). 1 Cc. ampoules.

6. **Eudrenin, R "B": Adrenalin Chloride,** 0.0001 Gm. (1:10,000); Beta Eucaine Hydrochloride, 0.0025 Gm. ($\frac{1}{4}$ of 1%). 1 Cc. ampoules.
7. **Iron Citrate (Green), 0.13 Gm.** (2 grains): Iron and Ammonium Citrate (Green), 0.13 Gm. (2 grains); Quinine and Urea Hydrochloride (as a local anesthetic), 0.005 Gm. ($\frac{1}{2}$ of 1%). 1 Cc. ampoules.
8. **Iron Arsenite, 0.065 Gm.** (1 grain): Iron Arsenite with Ammonium Citrate. 1 Cc. ampoules.

No.

9. **Iron Arsenite and Strychnine:** Iron Arsenite with Ammonium Citrate, 0.065 Gm. (1 grain); Strychnine Nitrate, 0.001 Gm. ($\frac{1}{85}$ grain). 1 Cc. ampoules.
10. **Mercuric Iodide, Red, 1% (Aqueous):** Mercuric Iodide, Red, 1% ($\frac{1}{8}$ grain); Soluble Salt of Para-amido-ethyl-benzoate (as a local anesthetic), 1% ($\frac{1}{8}$ grain); Potassium Iodide, 1% ($\frac{1}{8}$ grain); Distilled Water, q. s. 1 Cc. ampoules.
12. **Morphine and Atropine, R "A":** Morphine Sulphate, 0.016 Gm. ($\frac{1}{4}$ grain); Atropine Sulphate, 0.0006 Gm. ($\frac{1}{100}$ grain). 1 Cc. ampoules.
13. **Morphine and Atropine, R "B":** Morphine Sulphate, 0.008 Gm. ($\frac{1}{8}$ grain); Atropine Sulphate, 0.0003 Gm. ($\frac{1}{200}$ grain). 1 Cc. ampoules.
14. **Morphine and Hyoscine:** Morphine Hydrobromide, 0.01 Gm. ($\frac{1}{8}$ grain); Hyoscine Hydrobromide, true, 0.0004 Gm. ($\frac{1}{250}$ grain). 1 Cc. ampoules.
15. **Pilocarpine Nitrate, 0.02 Gm.** ($\frac{1}{8}$ grain). 1 Cc. ampoules.
16. **Pituitrin.** 1 Cc. ampoules.
17. **Quinine and Urea Hydrochloride, 1%.** 5 Cc. ampoules.
18. **Quinine Dihydrochloride, 0.25 Gm.** ($3\frac{3}{4}$ grains). 1 Cc. ampoules.
20. **Sodium Cacodylate, 3-4 Grain.** 1 Cc. ampoules.
21. **Sodium Cacodylate, 2 Grains.** 1 Cc. ampoules.
22. **Sodium Cacodylate, 3 Grains.** 1 Cc. ampoules.
23. **Sodium Cacodylate, 7 Grains.** $1\frac{1}{2}$ Cc. ampoules.
24. **Strophanthone, Dilute:** Strophanthone, 8 minims, diluted to 1 Cc. by normal saline solution. 1 Cc. ampoules.

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they are always ready for use.*

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The Small Garage

curves or approaches any angle of the house or its porch. The doors of the garage itself should open directly upon the end of this driveway, so that the ear may be run into the building in a straight line, and immediately in front of the structure the road should be widened considerably. This additional space may be used to advantage as a washing place for the car.

Time was when any kind of shed or old stable was thought to be good enough for the automobile. We know better now. Also we have learned that the garage may be and should be an ornament to the home grounds. Nor does achievement of this end demand any unreasonable expenditure. It is not even necessary to confine oneself in the matter of material to the cheaper grades of timber, though frame garages can and frequently are put up that are quite as attractive and as fully in keeping with their surroundings as those of brick or stone. But, within the limits of many cities, frame construction is barred by the building laws, and, in any event, a frame building increases the fire risk and does not give the same protection from excessive cold or heat as one with stone, tile, concrete, or brick walls. Whatever the material employed, however, the lines of the building should conform broadly to the architecture of the residence and it should be painted in accord with the colors of the latter. Also, within the limits of the owner's purse, the dimensions of the garage should be generous. The tendency of the inexperienced man of moderate means is invariably on the side of an economy in space which results in unnecessary discomfort, if nothing more serious. The average car demands a building of not less than sixteen feet length, inside measurement, and not less than

twelve feet width. The doors should give a clear opening of at least ten feet, and head room of eight feet six inches or more. Inside the building the head room should be not less than ten feet at the lowest point; otherwise the building will be stuffy and uncomfortable. There should be broad windows on three sides, with sills coming to within a foot of the floor, and each leaf of the doors may conveniently carry a square of glazing in addition. The sash of all windows should slide up and down so as to give free ventilation when needed, and bolted shutters should be fitted for the sake of additional protection from cold. In the interests of an abundance of light and ventilation it is a good idea to have a small raised skylight in the middle of the roof, the sash of which may be opened by pulleys and cords. The rafters of the roof should be stout enough to support the tackle which, sooner or later, will be needed by the man who makes his own repairs.

My own experience indicates that no floor is quite so satisfactory as that made of concrete. Concrete drains well, is impervious to moisture, and is easily kept clean. The floor should have a slight slope from the rear of the garage to the doors, and likewise slope gently from either side to a line down the centre of its length. The doors themselves should be made in two leaves, be of heavy framing, swing each on not less than three strong strap hinges, and the lintel should be raised an inch or more above the level of the floor, so as to lessen the chance of freezing fast in cold weather. This lintel should be bevelled off on both sides and may be slotted or bored through at the floor level of the building, so as to facilitate drainage. I do not believe in pits. At best they

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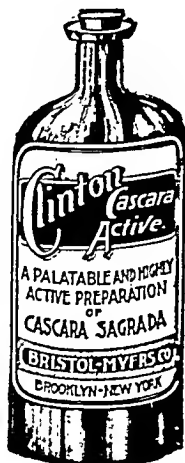
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The Small Garage

are damp, uncomfortable and unsatisfactory holes in which to work, and they become foul despite all precautions. Also gasoline and oil will collect in them, with the result some fine day of an explosion and fire from lurking fumes. Stout timber "horses" may be used instead to give the car enough elevation to permit one to crawl beneath it and make inspection or adjustments. There are also on the market now several styles of garage jacks, which enable the operator to hoist the entire car simultaneously from four points with little exertion. In either case, an old rug or piece of carpet spread upon the floor offers handy and reasonable protection to the workman from dirt and dampness, if only proper attention has been given to keeping the place clean from mud, dust and drippings from the car. A useful precaution against the spread of these last is a drip-pan, which the owner can make for himself from a sheet of twenty-gauge galvanized metal, four by six feet, by turning up the edges and bending the corners with a hammer and block of wood.

Great difficulty is usually encountered by the owner of the small garage in latitudes where the temperature falls below freezing, in heating the building. An oil or coal stove is safe only when every precaution has first been taken against communication of the flame with the fumes of loose gasoline, and even then should be used only when the owner himself is present. Hot water or steam heating is ideal but involves an expense which puts it without the reach of the average owner. The single expedient left to the man of small means, therefore, is to keep an anti-freezing mixture in the cooling water of the engine and allow the garage itself to remain unheated except

when he is in it. The cost of lighting the small garage with electricity is comparatively slight, and the immense convenience of this makes it in every way desirable. An exposed gas jet is at all times dangerous, and the owner had better do without artificial light entirely than take such risk. The illumination from the head lamps of the car will usually be found to be quite sufficient when driving into the garage at night. But running water, either in or adjacent to the garage, is an absolute necessity, and a faucet with a thread to take a hose union should be located just within the garage so that the washing of the car may be done as expeditiously and thoroughly as possible. A revolving overhead connection for washing purposes, as now provided in many of the large garages, is a convenience but by no means a necessity.

At the far end of the garage, against one wall, where light will fall upon it from two directions, should be fixed a work bench and heavy vise; and above this may be arranged wooden shelves for the store of small extra parts, bolts, nuts, screws, paints, varnish and such-like articles, which the man of a mechanical turn will find use for continually. Tools may be kept in drawers beneath the work bench or in wall-racks immediately above it. At the same end of the garage and on the opposite wall, may be placed heavy pegs to hold extra tires, and two rails one on which to hang robes and the other for chamois and wiping cloths. On the floor, under the work bench, is a good place to keep boxes in which to store the cans of lubricating and transmission oils, grease for the grease cups, polishing pastes, washing compound, and perhaps a small can of kerosene. Also there should be pro-



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The Small Garage

vided, convenient to the work bench, a good-sized box or metal can with a cover in which to throw waste and refuse of all sorts. This will be found to be a decided encouragement to cleanliness in the garage, but it should be emptied at frequent intervals; otherwise it is likely some day to transform itself into a lively bonfire, with disastrous results. Against this catastrophe it is well to have in the garage a box of sand, which is one of the best of fire extinguishers and likewise is useful to dry up such oil as may occasionally be spilled upon the floor. But even with sand handy, no garage should be without its chemical fire extinguisher, and the best of these is none too good for the man who values the safety of his car. A gasoline fire is a stubborn, alarming and quick-spreading affair. It must be instantly extinguished, and nothing but sand or a chemical compound seems to be effective. I take it for granted that every owner of an automobile realizes the folly of keeping within a building any store of gasoline, however small, except it be within the tank of the car. A pit three feet deep, four feet long and half as wide, dug in the ground just outside the garage, lined with inch boards and fitted with a frame cover that may be locked, will hold sufficient gasoline, in five-gallon cans, to meet the needs of the average man; and there is no danger of fire from gasoline so stored. If the owner feels inclined to spend a little more money, a metal tank to be placed outside the garage and furnished with piping and a pump for raising the gasoline, can be purchased for a fair price, and is somewhat more convenient. This, like some other articles of garage equipment, will appeal as a luxury rather than a necessity to the man intent

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The cost of constructing the driveway to the garage must, in each case, depend so largely upon its length and the nature of the material employed for a bed and top dressing, that no figures of general application could be quoted. It may be noted that the writer has secured excellent results from a driveway constructed of heavy cinders, watered and rolled repeatedly, the top layer being of finer cinders, and the final dressing of stone grit, well-watered and rolled down—the charge for this driveway being about one-half of that demanded for one made of stone.

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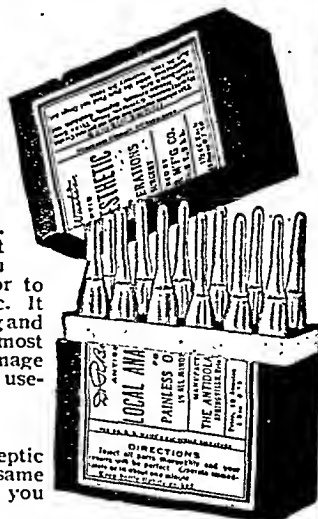
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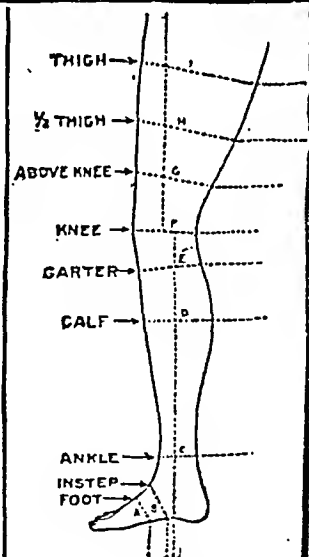
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ANNALS OF SURGERY

VOL. LV

APRIL, 1912

No. 4

ORIGINAL MEMOIRS.

CEPHALIC TETANUS.*

WITH REPORT OF A CASE.

BY ALFRED J. BROWN, M.D.,

OF NEW YORK,

Demonstrator of Anatomy, College of Physicians and Surgeons, Columbia University ;
Clinical Assistant, Department of Surgery, Vanderbilt Clinic.

OUR knowledge of the unusual form of tetanus variously known as cephalic tetanus, kopftetanus, and tetanus hydrophobicus is still so imperfect as to render desirable reports of individual cases, in the endeavor to ascertain the causation of so peculiar a clinical type of an otherwise well-known general disease.

The recognition and first description of the disease is usually ascribed to Rose,¹ by whom the name tetanus hydrophobicus was given; his priority has, however, been disputed by Eastman,² who gives the credit for the first description of the condition to Bell.³ At present the term cephalic tetanus is applied to those cases which present a paralysis or paresis of one or more of the cranial nerves as a prominent symptom, together with more or less well-marked symptoms of tetanus, generally confined to the region of the head and neck, though at times involving the entire body. Some authors have classified the condition as chronic tetanus on account of its usually

* Read before the Brooklyn Society for Neurology, December, 1911.

ERRATUM.

ARTERIAL SUTURING.

The illustration, Fig. 8, opposite page 211 of the February number of the *ANNALS OF SURGERY*, was reversed so that the legend below was incorrect. It should read:

“Fig. 8.—Three specimens of arterial suture from dogs. The lower specimen was removed in a few minutes after operation, the middle specimen two days after operation, the upper specimen thirty-three days after operation. The two lower specimens are carotid arteries, the upper one is a femoral artery. For further description see text.”

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long incubation period, but this is by no means invariably characteristic of this form. Others have classed as cephalic tetanus all cases in which the wound of entry has been on the head, irrespective of the symptoms presented. The cases mentioned here belong to the class above referred to, in which paresis or paralysis of one or more of the cranial nerves is present.

The disease is apparently very rare in the United States. Eastman² mentioned three cases as all he found reported in the literature up to 1907, and added three more. I have been unable to find any additional cases reported in this country to date.

The following case, the seventh reported in the United States, was seen by me in consultation with Dr. H. D. White, of Rome, New York, and through his courtesy I am permitted to report it.

CASE I.—C. R., male, farmer, aged forty years. His family and previous histories throw no light on his present trouble.

On Monday, September 6, 1909, the patient was struck over the right temporofrontal region by the tine of a mechanical manure spreader, which caused a lacerated wound of the forehead. The blow was severe enough to knock him down, and he thinks he was unconscious for a few minutes, was dazed for an hour or two, and suffered from a severe headache for the remainder of the day. The wound was cleansed and dressed by Dr. White; it was found to extend down to and at one point through the periosteum, but there was no evidence of fracture of the skull. The following day the patient felt practically well, and went about his work as usual on that day and on the day following. On Thursday, three days after the accident, the patient noticed that he could not perfectly control the right side of his mouth while eating and particularly when trying to take fluids. This was followed on the next day by twitching of the muscles of the left side of his face, which increased in severity, and soon tonic spasms of the muscles of mastication of both sides supervened, giving rise to a marked trismus. There were no constitutional symptoms and the patient did not feel sick in any way. The muscular spasms became so severe that six days after the acci-

dent, upon his admission to the Rome Hospital, he was unable to take any nourishment by mouth and his jaws were so tightly clenched that the teeth of his lower jaw were cutting into the gum of the upper, and it was necessary to extract six of them. Subsequent to this he was able to take liquid nourishment by mouth for a day, but on the following day it was necessary to resort to rectal feeding. There was some slight twitching of the extremities.

Physical examination at this time showed complete right-sided prosopoplegia determined by marked drooping of the corner of the mouth, obliteration of the nasolabial fold, and inability to close the eye or make a grimace on the right side of his face. There was marked spasm of the muscles of mastication of both sides, the jaws in consequence were tightly clenched, and it was impossible for the patient to open his mouth. When the patient wished to talk he placed his fingers between his lips to hold them apart. Any attempt to test the reactions of the right facial muscles resulted in such an increase of the painful spasm that this was given up after a very brief and unsatisfactory trial. There were occasional slight twitchings noted in the muscles of the extremities. The remainder of the physical examination revealed normal organs. The temperature (axillary) ranged from 98.6° in the morning to 100.5° in the afternoon, with a corresponding range in pulse and respiration from 64 to 92 and 16 to 20, respectively. The patient was given 1500 units of tetanus antitoxin subcutaneously.

For the next five days the above conditions persisted, and in addition exceedingly painful and distressing spasms of the pharyngeal muscles appeared, which were aggravated by any attempt at swallowing. For two days there were also severe respiratory spasms, and at times a restless delirium with a temperature reaching 103° , pulse of 100 to 124, and respirations 20 to 32.

On the tenth day of the disease a slight conjunctivitis and keratitis developed in the right eye, which promptly subsided under appropriate treatment.

On the twelfth day of the disease the spasms of the muscles of mastication began to decrease; the patient was able to take nourishment by mouth and appeared to be improving. The temperature range was a little lower.

and since that date I have found 12 cases, the one here reported making 13, thus bringing the total to date to 94 cases.

In 84 per cent. of cases the first sign of the disease has been trismus, either alone or accompanied by paralysis of one or more of the cranial nerves. The paralysis, however, usually follows the trismus. In 14 cases, including the one here reported, prosopoplegia has preceded the appearance of the trismus. Ross⁵ asserts that the appearance of this symptom before the trismus determines an almost invariably fatal termination, but this observation does not appear to hold good in the series to date, as of the 14 cases but 9 have died, thus making a mortality of 64.2 per cent., as contrasted with a mortality of 53.2 per cent. for cephalic tetanus as a whole. The 13 previous cases in which paralysis has preceded the trismus have been reported in detail by Stolz.⁷

Neumann⁶ claims that the facial nerve is involved most frequently, then the oculomotor, abducens, trochlear, and hypoglossal in the order named, but at the same time states that the cases are too few in number to make any dogmatic rule. This observation has proven true in the series to date.

Prosopoplegia is by far the most common form of paralysis and appears on the side of the lesion. Cases of crossed paralysis have been reported but are open to doubt as to the site of infection.

Bilateral prosopoplegia has been reported in seven cases. In all but one case, that of Roberts,²¹ the wound has been across the median line of the head, usually across the bridge of the nose. Not all median line wounds, however, have given rise to bilateral prosopoplegia (Nankivell,²² Wagner,²⁴ Oliva,²³ and Nerlich¹⁶).

Paralysis of one or more of the muscles of the eye has been described, and in these cases the wound has involved the orbit. The paralysis has varied from complete ophthalmoplegia to paralysis of one nerve only. Ptosis has been noted in eight cases, strabismus in four, nystagmus in one. Fixed dilatation of the pupil has been described.

Paralysis of half the tongue denoting involvement of the

On the fifteenth day the patient developed severe paroxysms of coughing, and at the same time complained of a pain in his right shoulder and the right side of his chest which was increased by coughing or taking a deep breath. The attacks of coughing lasted for from 15 to 20 minutes, being induced especially by any endeavor to take food, and in consequence rectal feedings were again instituted. These severe paroxysms continued at intervals until the twentieth day, when they began to decrease in severity and soon disappeared. On the seventeenth day he had a chill lasting a few moments and followed by a rise in temperature to 101.1° , and this was repeated on the eighteenth day, this time being more severe, and followed by a rise of temperature to 104.2° . On the following day the temperature fell rapidly to normal and remained there. Physical examination during the above period elicited the signs of dry pleurisy on the right side, consequently it seems reasonable to assume that the symptoms were entirely distinct from the symptoms of tetanus which had preceded them.

At the time of the fall of temperature to normal, the trismus had so far relaxed that it was deemed safe to take the patient's temperature by mouth. From this time on the convalescence was rapid and the patient was discharged on the twenty-eighth day after his injury, with a very slight prosopoplegia remaining and with the wound healed by granulation after a mild suppurative course.

From the sixth until the fourteenth day of his disease inclusive, the patient received 65,500 units of tetanus antitoxin, injected subcutaneously in ten doses ranging from 1500 to 11,500 units at a dose.

A stab culture taken from the wound was examined bacteriologically by Dr. W. S. Nelson, of Utica, New York, and a preliminary report of bacilli closely resembling tetanus bacilli but without spores was made. Owing to the sudden illness and death of Dr. Nelson, further investigations which were under way were never completed.

REVIEW OF CASES REPORTED IN MEDICAL LITERATURE.

Willard ⁴ in 1895 was able to collect 74 published cases in the literature, his own case making 75. Ross ⁵ in 1906 presented an analysis of 81 cases in the literature up to that time,

and since that date I have found 12 cases, the one here reported making 13, thus bringing the total to date to 94 cases.

In 84 per cent. of cases the first sign of the disease has been trismus, either alone or accompanied by paralysis of one or more of the cranial nerves. The paralysis, however, usually follows the trismus. In 14 cases, including the one here reported, prosopoplegia has preceded the appearance of the trismus. Ross⁵ asserts that the appearance of this symptom before the trismus determines an almost invariably fatal termination, but this observation does not appear to hold good in the series to date, as of the 14 cases but 9 have died, thus making a mortality of 64.2 per cent., as contrasted with a mortality of 53.2 per cent. for cephalic tetanus as a whole. The 13 previous cases in which paralysis has preceded the trismus have been reported in detail by Stolz.⁷

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Paralysis of half the tongue denoting involvement of the

hypoglossal nerve has been noted in two cases as the trismus was disappearing.

The site of the wound has been on the head or face in all but two cases. Duvergey⁸ reports a case in which the site of infection was supposedly under the finger-nail, thus leaving room for doubt as to the site of the lesion, and Zack⁹ reports a case of cephalic tetanus following a wound of the foot.

The prognosis depends upon two factors: first, the length of the incubation period; as a general rule it may be said that the shorter the incubation period, the more dangerous the disease; and second, upon the localization of the tetanic spasms. In those cases in which the spasms remain localized in the muscles of mastication and deglutition, the prognosis is good, regardless of the length of the incubation period. If respiratory spasms supervene, the prognosis is more grave, as death may and often does occur during a spasm. If the spasms become generalized, the prognosis is almost invariably fatal.

With regard to the etiology of the condition, a sufficient number of cases have been reported in which tetanus bacilli have been obtained by culture from the wound to make it practically certain that the disease is due to this infection.

Regarding the pathology of the paralyses, however, many theories have been advanced. Rose¹⁰ claims that the paralysis is caused by a local inflammation of the seventh nerve, causing a swelling of its trunk and a consequent constriction at its exit from the stylomastoid foramen. This view is not supported by autopsy findings, as such conditions have never been observed and in all cases reported the nerve-trunk has been found normal on microscopical examination.

Serems¹¹ has suggested that the paralysis is reflex from involvement of the fifth nerve.

Brünner¹² believes that the paralysis is caused by a selective toxin which is paralytic in its action and affects the end organs of the nerve-fibre. He notes the fact that Fraenkel and Kitasato have been able to produce the facial and ocular palsies in rabbits by the injection of the crude toxin into the facial muscles, but at the same time there has been a reaction

of degeneration present in the affected muscles, while in cephalic tetanus the prosopoplegia is of the character of Bell's palsy and presents no reaction of degeneration. Klemm¹³ also advocates the above theory.

Binet and Trénel¹⁴ state that contraction and paralysis of muscle due to nerve impulse are two phenomena of the same order corresponding to two different states of the nerve-cell. The first phase, causing contraction, is excitation; the second, causing paralysis, is complete annihilation. Consequently the effect on the nerve-cell is governed by the amount of toxin transmitted along the nerve-fibre to the nucleus. They argue that the seventh nerve is usually first involved, or if the lesion be in the orbit, the third, and there is sufficient strength in the toxin to cause annihilation of the cells of the nucleus and consequent paralysis. By the time the toxin reaches the motor nucleus of the fifth nerve, however, it is so attenuated that excitation of the cells is caused and spasm results.

Gosselin¹⁵ asserts that there is no true paralysis of the cranial nerves, but the muscles of the opposite side are in excessive contraction, and consequently there appears to be a paralysis of one side. This view is sufficiently refuted by the occurrence of bilateral prosopoplegia.

Nerlich¹⁶ was the first to suggest that the toxin acts on the motor cells in the central nuclei, basing this assumption on the fact that he noted bubble-shaped lesions in the motor cells situated in the nucleus of the twelfth nerve on the side corresponding to the lesion and in both seventh nerve nuclei. The wound in his case was across the bridge of the nose, but the patient exhibited left-sided prosopoplegia only.

Berkhardt¹⁷ reports lesions in the brain stem at the level of the nucleus of the seventh nerve.

Bourgeois¹⁸ states that he has found pigmentation in the nucleus of the twelfth nerve.

The method by which the toxin reaches the central nervous system is by passage along the nerve-fibre from the point of injury as shown by Marie and Morax.¹⁹ The toxin presumably travels by lymphatic paths.

Von Orzechowski²⁰ reports a fatal case in which he found the nuclei of the third, fourth, fifth, and sixth nerves normal. In the nucleus of the seventh nerve corresponding to the side of the lesion there was a group of cells in the ventromedian portion which showed chromatolysis. There was also vacuolization of cells which corresponded to the description of Nerlich. He quotes Goldscheider and Flatau, Goebel, Matthes, Von Halbau, Sjovall, and Kron as having also found the same lesions. He also notes the same vacuolization of cells occurring lower down in the cord, and the history of his case shows that the patient suffered a wound not only on his face but also on the chest, and suffered from generalized spasm as well as from prosopoplegia. This would tend to show that the lesion in the central nucleus is localized in an area corresponding to the site of the lesion of the nerve, whatever that may be.

From the weight of evidence at the present time, it seems fair to assume that the paralysis is due to the action of the toxin upon the nucleus of the nerve which supplies the muscles in the neighborhood of the injury. The toxin is carried to the nerve through the lymphatics, and thence transmitted along the nerve-trunk by the lymphatics to the nucleus. If this point be granted, may it not be true that this condition may be present in any portion of the body? Prosopoplegia would be noted particularly by contrast to the spasm of the opposite side of the face, whereas, on the other hand, paralysis of individual muscles or muscle groups in other parts of the body would easily escape detection by being overshadowed by the general spasm.

In the cases of cephalic tetanus, many which have resulted fatally have shown generalized tetanus and have also shown wounds outside of the facial area, as did Von Orzechowski's. When this has not been the case the fatal issue has often occurred in a respiratory spasm. The early symptom of general tetanus is trismus as the common name of the disease, lockjaw, implies. This in general tetanus is followed by pharyngeal and respiratory spasm, stiffness of the neck, and

gradual passage of the area of spasm down the body, thus denoting a passage of the toxin downward along nerve-trunks. At the same time it is now fairly well established that the toxin gains access to the central nervous system through lymphatic paths.

Turning now for a moment to the consideration of another grave condition which travels by lymphatic paths, carcinoma, we find that there has long been recognized a portion of the body, sparsely supplied with lymphatics, in which carcinoma is quite benign. This area is bounded below and behind by a line drawn from the lower border of the ala of the nose backward to the inferior border of the lobule of the ear, and thence vertically upward through the external auditory meatus to the median line, where it meets a corresponding line of the opposite side. Carcinoma occurring in this area rarely gives rise to metastases or cachexia, and aside from the local lesion is comparatively benign. It seems fair to assume then, reasoning by analogy, that tetanus occurring in this same area, without a wound of any other portion of the body, will, because of the limited absorption of the toxin by the lymphatics, be of a benign form and present only the early symptoms of the disease, namely, trismus, pharyngeal and respiratory spasm, while exactly the same infection, occurring in other parts of the body, owing to the plentiful lymphatic drainage, will be absorbed more rapidly and in greater amount, and will, in consequence, give rise to generalized spasm.

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TREATMENT OF HEART WOUNDS.*

REPORT OF SUCCESSFUL CARDIORRHAPHY AND TABULATION OF CASES.

BY EUGENE H. POOL, M.D.,

OF NEW YORK,

Attending Surgeon, French Hospital; Associate Attending Surgeon, New York Hospital.

On July 18, 1911, at 7.10 P. M., a young man, twenty-four years old, a native of Sicily, was brought to the New York Hospital in the ambulance about 30 minutes after he had attempted to commit suicide by stabbing himself with a knife over the heart. He was admitted to the service of Dr. A. B. Johnson, to whom I am indebted for the privilege of treating the case.

I was at the hospital when the patient was brought in and saw him immediately. He was a small, thin man in a condition of profound shock. He was lethargic, and no facts concerning the injury could be elicited from him. The pulse was imperceptible in the radial arteries; the heart sounds were audible but distant and muffled. Percussion indicated an increase in the area of cardiac dulness, though we did not delay to map it out accurately. There was a wound about one-half inch in length in the fourth intercostal space close to the upper border of the fifth rib and just mesial to the nipple. A probe inserted a short distance showed that the direction of the wound was somewhat upward and inward. There was very little external hemorrhage. It seemed reasonably certain that there was a wound of the heart and that death was imminent unless immediate operation could be successfully performed. As the operating room had been prepared for another operation, it was possible to put the patient on the table without delay and to begin the operation less than an hour after the accident.

The wound was protected with gauze and the surrounding skin thoroughly cleansed, after which the wound and the operative field were painted with 3.5 per cent. tincture of iodine. As the patient seemed to experience some pain when the iodine came in contact with the wound, light ether anæsthesia was begun at

* Read before the Surgical Section of the New York Academy of Medicine, January 5, 1912.

once. The wound was extended along the upper border of the fifth rib toward the sternum, crossing and dividing the cartilage near its insertion. The stab wound entered the pleura, and in exposing the pericardium the pleura was injured further. The pericardium was incised in the direction of the wound, allowing the escape of considerable blood, and the index-finger was inserted into the pericardial sac. It failed to locate the wound in the heart, but palpation of the inner surface of the pericardium revealed an opening in it, corresponding in position to the original surface wound. The exposure of the heart was rapidly improved by making a "trap door." For this the incision was carried upward along the sternum and thence outward along the lower margin of the third costal cartilage. The cartilages of the third and fourth ribs were divided close to the sternum, the third being readily exposed by retracting the soft parts upward. The two cartilages were then carefully lifted, separated from the pleura, and fractured at the costochondral junction, forming a flap with skin and muscles attached; resection of the fifth cartilage was contemplated but was delayed and did not prove necessary. The internal mammary was clamped and ligated above and below when exposed. The opening in the pericardium was enlarged by an incision upward near the sternum, making a triangular flap. Hemorrhage was very free; the operative field was a lake of blood in which were churned bubbles of air.

Palpation revealed the rent in the heart, which admitted the tip of the index-finger. As the finger was withdrawn from the hole a well-vaselined silk suture was passed from above downward on a fine curved intestinal needle; this was tied and left long. By gentle traction on this suture the heart was readily lifted and rotated, so that the wound was rendered visible and readily accessible. The wound involved the left margin of the heart somewhat posteriorly; it was about one-half inch in length, transverse on the long axis of the heart, and approximately one and one-half inches above the apex. Though the wound was partially closed by the first suture, blood gushed out whenever the finger was momentarily lifted to pass a stitch. Five stitches were inserted and tied before the bleeding was completely controlled. All visible blood was then removed and the pericardium closed with interrupted catgut stitches. There was considerable tension between the edges of the pericardial wound, which caused

some gaping between the stitches in the lower mesial part. The flap was replaced and chromic stitches used to repair muscles and fascia. The skin was closed with silk. In the outer angles of the wound rubber tissue drains were inserted through the skin. At the lower mesial angle of the wound a rubber tissue drain was inserted down to but not into the pericardium. After the wound in the heart had been closed an infusion of 16 ounces of salt solution was slowly given. The operation took about thirty minutes.

Post-operative Course.—For 24 hours after the operation the patient was restless, irritable, and thirsty. He was given morphine freely and saline continuously by rectum (Murphy drip). During this time the highest pulse-rate was 128; respirations were 24–28; temperature 102°. When the dressing was changed at the end of 16 hours and the drains removed, a very large quantity of clear serum exuded from the drainage openings. A rubber tissue drain was therefore reinserted at the lower inner angle. A similar discharge occurred again at the next dressing 30 hours after the operation. At that time the pulse had risen to 132; the temperature remained 102°. White blood-cells were 19,000, polymorphonuclears 83 per cent. The serous discharge continued to be free until 48 hours after the operation, when the single remaining drain was removed from the lower and inner angle of the wound. At this time the pulse was 112, temperature 101°, respirations 24. The patient was refractory and refused to eat, because, he said, he wanted to die; he was also very irritable and restless. Twice he sat up in bed. Morphine was given and he became quiet. Rectal alimentation was begun.

July 22 (fourth day): condition good, pulse 104–124, temperature 102°. White blood-cells 17,500, polymorphonuclears 84 per cent. Patient still refused nourishment. Wound dry and clean.

July 23: condition about the same.

July 24 (sixth day): large amount of serum exuded from the wound, after which the pulse became very rapid.

July 25 (seventh day): constant free discharge of clear serous fluid requiring frequent dressings. The patient still refused nourishment, was extremely weak, and appeared to be in serious condition.

Blood-pressure taken twice a day from the third to the eighth days was always between 90 and 110.

July 26 (eighth day): the patient was persuaded to eat by threats of passing the stomach tube; nutrient enemata were discontinued. Wound dry and clean, temperature normal, pulse 90, white blood-cells 10,000, polymorphonuclears 74 per cent. From this time the convalescence was uneventful. The patient was allowed up on the eighteenth day and discharged from the hospital on the twenty-fifth day.

The man was seen on December 12, four and a half months after the operation. His general condition was excellent. The heart-beats were visible in the fourth interspace three and a half inches to the left of the mid-line; there was a very slight systolic thrill at the apex. Prominences at the sternal attachments of the third and fourth cartilages, where these had been cut, were visible and palpable, also slight depressions where they had been fractured at the pedicle of the flap. Otherwise, examination of the chest revealed nothing abnormal.

The rationality of immediate surgical treatment for wounds of the heart has been thoroughly established by fifteen years of relatively good and constantly improving results. Even in suspected wounds of the heart, when the diagnosis is probable but not positive, exploratory operation is an approved procedure, as has been emphasized by E. Hesse, Foederl, and others, for the following reasons: First, there is no typical clinical picture whereby a wounded heart can always be diagnosed, especially in the first few hours after injury. The classical syndrome, "heart tamponade," due to intrapericardial pressure, is more often absent than present (Borchardt); physical signs in the cardiac region, such as abnormal sounds and increased dulness, are frequently inconclusive; the position and direction of the surface wound are not always convincing; while the suggestive symptoms of internal hemorrhage, hæmothorax or hæmopneumothorax may originate entirely in thoracic lesions other than a heart injury. Thus, in the 21 cases which were the basis of E. Hesse's report, heart tamponade was absent in 13; in only 11 of the 21 cases was

FIG. 1.



Photograph taken on the eighteenth day after operation (author's case).

the diagnosis certain, whereas in 4 it was probable and in 6 doubtful on account of the absence of all reliable signs. Second, it has been shown by statistics that the prognosis, by reason of hemorrhage and shock, becomes progressively worse as the interval between the trauma and the operation lengthens. Therefore, although delay in some cases will render the diagnosis certain, postponement of operation until dangerous symptoms make their appearance is not to be recommended. Third, the immediate results of non-operative treatment are very poor as compared with those obtained by operation (E. Hesse). Moreover, although some heart wounds heal without surgical intervention, there is always danger of secondary hemorrhage from an unsutured wound, and the spontaneously healed heart wound, even a non-perforating wound, leaves a weak scar which may rupture or become the site of an aneurism (Rehn). Loison, as early as 1899, collected nine such cases.

The technic of operation for wounds of the heart may be dismissed briefly, since a number of recent articles enter exhaustively into discussion of the details. There are only a few features on which it is necessary to dwell. These are the use of differential pressure, the method of exposing the heart, and the question of pericardial and pleural drainage.

Technic of Operation.—Careful preparation of the operative field is essential, since many cases which have survived shock and hemorrhage have died later as a result of infection. Experience indicates that anæsthesia should consist in the sparing administration of a general anæsthetic, preferably ether, when the patient shows signs of sensibility. The indications for differential pressure are so striking as to induce its employment. Since the recent development of the Meltzer method, it has become possible for every hospital to be provided with facilities for the use of differential pressure, even if elaborate apparatus, such as those of Janeway and Elsberg, are not available. Therefore, the applicability of differential pressure in operations for wounds of the heart will doubtless

be thoroughly tested in the immediate future, consequently, this detail deserves careful consideration.

A majority of the cases of heart wounds are complicated by opening of the pleura (Borchardt); Sauerbruch puts the figure at 80 per cent. Even if not opened by the original wound, experience shows that the pleura is usually torn during the course of the operation. Pneumothorax with collapse of the lung is therefore likely to occur in every case. But the immediate dangers due to pneumothorax can be eliminated and the late dangers minimized by the use of differential pressure. Therefore, differential pressure permits a disregard of the pleura, and, consequently, expedites the operation by allowing a free transpleural exposure; moreover, it greatly diminishes the tendency to post-operative infection, by allowing dilatation of the lung and consequent absence of pneumothorax following the operation (Sauerbruch). Other less important advantages of differential pressure are that it increases oxygenation of the blood, improves the heart action, renders the technic of the heart suture easier in that it lifts the heart and renders it more accessible, at the same time removing the annoying respiratory movements, and, finally, assists in the discovery of a wound of the lung so that it may be sutured (Sauerbruch and Haecker).

There are some considerations which indicate great care in the amount of pressure used during the first stages of the operation. Sauerbruch and Haecker found in animal experiments that at first a pneumothorax leads to a diminution of heart activity and lessens the bleeding from the heart. On the basis of these findings Matas discourages the use of differential pressure until the heart has been sutured, because he considers that a collapsed lung may be an advantage by diminishing the bleeding from the heart wound. But Sauerbruch and Haecker state that in their experiments continuation of the collapsed lung led to such depression of the heart as to render it necessary to dilate the lung in order to save the animal, and Sauerbruch believes that low pressure, such as 3

mm.Hg, does not increase the bleeding. Therefore, although Matas's warning should be borne in mind, it seems probable that differential pressure, in view of its marked indications, may be used throughout with advantage, danger from increased hemorrhage being averted by a rapid exposure and rapid control of hemorrhage, pressure being reduced to a minimum until bleeding has been controlled. Possibly insufflation of oxygen will prove an advantage in this connection, since it can be used under much lower pressure than is necessary to give the same effects with air (Volhard, Tiegel). In operations for heart wounds, differential pressure has been employed in one case by Friedrich and in four cases reported by Ranzi. As a result of his experiences, Ranzi expresses himself very positively in favor of its use.

The question of exposure of the heart is greatly simplified if it is recognized that an extrapleural cardiorrhaphy is rarely possible, and if dependence is placed upon differential pressure for controlling the dangers of pneumothorax. The numerous methods which have been suggested for exposing the heart will not be enumerated here. The principles of exposure by which almost all indications can be met most satisfactorily are the intercostal incision, the osteoplastic flap, and the extrapleural exploratory pericardiotomy.

The intercostal incision, as Wilms states, affords free exposure of the heart, can be applied much more quickly than a flap operation, and causes less hemorrhage, while the resulting pneumothorax cannot be urged against the method since it is rarely possible to avoid its occurrence by other procedures. It should be elected when differential pressure is used, when pneumothorax is already present, or when the condition of the patient makes speed of primary importance. A long intercostal incision placed in the fourth space gives the best exposure, although other spaces may be used. The proper application of this incision necessitates opening the pleura freely; forcible retraction then gives considerable exposure. As in all methods, the internal mammary must be ligated

above and below when exposed. After opening the pericardium in the line of incision, if more space is desired, it may be obtained by cutting away part of the sternum and by section near the sternum of adjacent rib cartilages with or without incision of the soft parts upward or downward.

Although the preservation of the pleura, as Rehn points out, is a distinct advantage, it should be aimed at only in selected cases, since the effort delays the operation and usually fails. The circumstances which warrant an effort toward an extrapleural operation are: differential pressure not available, pneumothorax not present, no wound of the pleura such as would render the effort useless, adequate assistance, and relatively good condition of the patient, for when the condition is grave it is important to adopt the simplest and quickest method and to lose no time in attempts at elaborate extrapleural procedures.

Certain flap methods afford good exposure and offer the best prospects of preserving the pleura intact, when such an effort appears indicated. A flap with lateral base has proved the most satisfactory both in operations and experimentally on the cadaver. A flap, as planned by Kocher, gives admirable exposure. An incision of about 10 cm. is made from the middle of the sternum along the sixth left costal cartilage, which is carefully resected after separating the perichondrium; the pleura is exposed and stripped outward; an extrapleural exploratory pericardiotomy is then possible. From the inner end of this incision, a vertical incision is carried upward on the sternum as far as is indicated, even to the third rib; a third incision of 8 cm. is carried horizontally outward. A flap of the fifth, fourth, and, if necessary, third cartilages is lifted, separating and stripping the pleura outward. The cartilages are broken at the costochondral junction. In the event of a small wound being made in the pleura, an effort should be made to limit the entrance of air into the cavity by protecting the hole with gauze; a large wound must be disregarded. This method not only gives a good exposure, but

permits satisfactory primary or secondary drainage in a dependent part of the pericardium and the part uncovered by pleura. Yet for some cases it would carry the exposure unnecessarily low. Therefore, in high wounds a simpler and more suitable procedure may be used by omitting the resection of the sixth cartilage and forming a flap appropriately placed with pedicle outward of two or three rib cartilages, especially the fourth, fifth, and third. Additional space in the direction needed may be obtained by cutting away part of the sternum and section or resection of adjacent cartilages. The pleura should be carefully separated and stripped outward.

In certain doubtful cases the primary incision may be designed for exploration. The original wound, if situated in the precordial region, may then be extended and deepened layer by layer, the edges of the original wound being excised (Peck). If it appears indicated, the incision may be utilized for carrying out one of the methods of exposure already mentioned or for an appropriate atypical exposure. If the wound is not in the precordial region, in the absence of differential pressure, an extrapleural exploratory pericardiotomy may be used advantageously. For this, resection of the sixth cartilage, as in the first step of Kocher's procedure, is to be recommended. In the rare condition of a wound of the right side with right pneumothorax, the exposure of the heart must be planned to avoid opening the left pleura, especially when differential pressure is not used. Partial resection of the sternum is then indicated. König suggests as the best procedure that of Marion with the modifications of Wehr and Lorenz.

After exposure of the heart, if any difficulty is encountered in locating the wound, the index and middle fingers of the left hand may be inserted posterior to the heart, the thumb being placed on its anterior surface, and it may then be lifted, turned, or drawn downward for inspection (Rehn, quoted by Sauerbruch). But if hemorrhage is excessive, the method suggested by Sauerbruch and Haecker may be advantageously

used: the left hand is inserted so that the right auricle with its entering vessels lies between the third and fourth fingers, while the thumb and index-finger grasp the lower portion of the heart and luxate it upward; this, they say, serves to bend the vessels and control bleeding, while at the same time the heart wound is rendered accessible. Rehn suggests controlling hemorrhage by compressing the inferior and even the superior vena cava with the fingers of the left hand.

For suturing the heart, both chromicized catgut and silk have been used. Yet the interrupted silk suture well vaselined has much to commend it, in that it offers a finer material, which causes the minimum of trauma, is well tolerated, allows the knots to be tied more securely, and is not loosened by subsequent softening of the suture material at the knots. In a case of wound of the left ventricle reported by Schoenborn catgut sutures were used and were found at autopsy a few hours later so loose that they probably would have given way.

After the controlling stitch has been placed, it should not be difficult in most cases to insert the remaining stitches. In our case this was done quite easily by having the assistant draw on the first stitch with one hand and control the bleeding by pressure with a finger of the other hand; for each subsequent stitch this finger was momentarily lifted. It was found impossible to differentiate between systole and diastole in tying the sutures, and case reports show this to be a common experience. The suture should not penetrate the heart wall, yet reports indicate that in thin-walled portions of the heart it is impossible to determine accurately the depth of a suture. Occasionally, as in cases reported by Neumann and E. Hesse, cardiorrhaphy is unsuccessful on account of friability of the heart muscle and persistent cutting through of the sutures. In such an event the latter recommends cardopericardoplasty.

For cessation of the heart action during operation, gentle massage is indicated. Injections of salt solution into the cavity of the left ventricle (Gütig) and camphor (F. Hesse) or adrenalin (Leichner) into the wall of the ventricle have been tried but without very encouraging results.

After the heart has been repaired, a saline infusion should be begun and the lung should be inspected when an injury seems probable, because a neglected pulmonary injury may lead to a fatal outcome. Death in one of Heinrichsen's cases was due to a simultaneous injury of the lung which had been overlooked. The importance of this step is further emphasized by statistics, which indicate that the lung is injured in a large proportion of cases, 13 per cent. of stab wounds according to Loison.

The closure of the pericardial sac should be made with interrupted catgut sutures, because tension between the edges of the wound may occur not only at the time of operation but later as the result of distention of the sac with serum, consequently distribution of the strain among a number of stitches renders the suture more secure.

The question of drainage is important, since a large proportion of cases are lost as a result of the infection of the pericardial or pleural cavities. It is fair to assume that faulty judgment in the matter of drainage is often responsible.

There are strong arguments for and against pericardial drainage which may be briefly considered: it is probable that a considerable post-operative exudation of serum, due to traumatic pericarditis, is not infrequent after operations on the heart, as is evidenced by the cases of Magenau and Torre, which were not drained, and the case here reported, in which no drain entered the pericardial sac. Should this serum be confined within the pericardial sac, the heart action may be impaired, as in the cases of Proust and Magenau, in which the heart action improved after liberating the fluid; should it accumulate in the soft parts outside of the pericardial sac, it would favor extensive suppuration. Hence an exit for this fluid would prove an advantage. If infection has been introduced by the original wound or during the operation, drainage will obviously be an advantage. If care be taken in the dressings, subsequent infection should not occur, since the discharge, although free, persists as a rule for only a few days. While dangerous accumulation of serum may be removed by

aspiration, the procedure is not without danger, and the indications are not clear until serious symptoms have developed.

On the other hand, the irritation of a drain projecting into the sac might reasonably be supposed to favor excessive exudation, as occurred in the cases of Schoenmaker, Proust, Neugebauer and Renner, and the formation of adhesions, which militate against the best functional activity. That serious results may be due to adhesions is shown by Walther's case of stab wound of the right ventricle which was sutured. Three years and eight months after operation death occurred as the result of cardiac insufficiency. At autopsy extensive cardiopericardial adhesions were found; the cicatrix appeared as a wide translucent area, and at this site the heart wall was very thin, though there was no aneurism.

It is evident that drainage in each case must be decided by the individual indications. In some cases in which there is short exposure and little trauma, closure without drainage should be carried out; on the other hand, when the nature of the wound and the operation render infection probable, the drain should penetrate slightly into the sac. But in doubtful cases, on the basis of the above reasoning, it appears safest to treat the detail of pericardial drainage as follows: First, to leave unsutured a small portion of the lowermost, or in an intercostal incision the innermost, part of the pericardial wound, so that in the event of a large accumulation of serum the fluid may exude through the opening, and, second, to provide a surface exit for the serum by inserting a drain down to but not into the pericardial sac. This method proved fairly satisfactory in our own case, although the drain was too small and not sufficiently loose to allow continuous drainage. A cigarette or rubber tissue drain should prove most satisfactory. As suggested by case reports, any form of drain, such as gauze, which is likely to obstruct and not drain should be avoided. On the other hand, a rubber tube while best for drainage might communicate with the pleural cavity when this has been opened, especially in an intercostal incision, and cause a pneumothorax.

Drainage of the pleural cavity has been urged, notably by F. Hesse, on the theory that infection in the pleural cavity that has been opened is peculiarly prone to occur, not only as the result of the wound or ordinary operative infection, but as the result of air infection, since air is sucked in and expelled with every respiratory movement. Moreover, the pleural resistance is diminished by prolonged exposure to the air, operative traumatism, post-operative pneumothorax, and the persistence of blood or the accumulation of exudate in the cavity. Further, the pleura does not react to the same degree as the peritoneum, in localizing inflammatory processes through adhesions.

Against drainage may be urged the resulting pneumothorax, which can be entirely eliminated by differential pressure when drainage is not used; and the danger of infection from without, as the result of the drainage. Infection in a drained case is difficult to prevent because the discharge in such cases is usually copious and prolonged (cf. cases of F. Hesse, 1909, Einar Key, and others).

Statistical analyses of the reported cases do not aid as much as might be expected in deciding the question of drainage, since conclusions based on the statistics are not convincing by reason of the numerous modifying factors of each case, such as associated pericardial and lung lesions. Further, accurate statistics are impossible, because many unsuccessful cardiorrhaphies remain unpublished; moreover, complete details of published cases are often not given. Yet, recent writers have been somewhat influenced by statistical studies. Thus E. Hesse favors closure of pleura and pericardium on the basis of his own experiences and the following statistical considerations:

Pericardium and pleura were closed in 30 cases, 21 (70 per cent.) recovered.

Pericardium and pleura drained in 43 cases, 25 (58 per cent.) recovered.

Pericardium closed, pleura drained in 25 cases, 10 (40 per cent.) recovered.

Pericardium closed, no statement as to pleura, in 15 cases, 10 recovered.

Pericardium drained, no statement as to pleura, in 8 cases, 4 recovered.

Hesse's personal cases in which the patient survived operation: both closed 6 cases, 5 cures; both drained 6 cases, 1 cure; pericardium closed, pleura drained 3 cases, 0 cures.

On the other hand, although the statistical compilation of Rehn (1907) does not show the advantage of closure of the pleura, Rehn proclaimed himself against pleural drainage.

It is my opinion that the pleural cavity should not be drained as a "prophylactic" step against possible infection unless there are very strong reasons for suspecting infection. In general, the accumulated blood should be removed entirely from the pleural cavity by aspiration and gentle sponging, avoiding, as far as possible, injury to the pleura. The pleural wounds should be carefully closed with distention of the lung if differential pressure is used. Evidences of pleural infection should be watched for, and, if necessary, drainage be established later, as has been done in a number of cases. In exceptional cases where exposure has been prolonged and when from the nature of the wound and its administration infection appears probable, the thorax should be drained, especially if differential pressure has not been used. The drainage should be made posteriorly just as in empyema; as emphasized by F. Hesse, anterior drainage can be of little use.

The number of reported cases of heart suture has increased rapidly in the last few years. E. Hesse (Russia) reports twenty-one cases which were treated by cardiorrhaphy in the Obuchow Hospital in St. Petersburg, four more being added during the preparation of the paper. F. Hesse (Germany) contributes three more cases operated upon by him. He and others likewise report quite a number of old cases not previously published.

E. Hesse (1911) was able to collect 219 cases with 116 deaths and 103 recoveries. He points out that this ratio

gives a false impression of the percentage of cures, because numerous failures are doubtless not reported. He calls attention to the relatively small number of cases in the United States and England and the large number in Italy and Russia.

An effort has been made, with the co-operation of Dr. F. Robbins, to tabulate 77 cases of heart suture reported in 1909, 1910 and 1911, including earlier cases not previously reported, in order to supplement the table of 159 cases published by Peck in 1909, bringing the total to 236.

CONCLUSIONS.

1. The treatment of heart wounds should be surgical. Even in suspected wounds of the heart, when the diagnosis is probable but not positive, exploration should be performed.

2. Careful preparation of the field of operation is essential, since many fatal results have been due to sepsis.

3. Light general anæsthesia, preferably ether, should be given when there are signs of sensibility.

4. It is important to recognize that in a large proportion of heart wounds the pleura is opened and that an extrapleural cardiorrhaphy is rarely possible.

5. Differential pressure offers marked advantages chiefly by eliminating the immediate and minimizing the late dangers due to pneumothorax. Its use expedites the operation by allowing a free transpleural exposure. But prior to the control of bleeding from the heart wound positive pressure should be used with great care because it may increase hemorrhage.

6. (a) A transpleural exposure with long intercostal incision is ordinarily the best because it affords free exposure of the heart, can be applied much more quickly than other procedures, and causes less hemorrhage. This exposure should be employed when differential pressure is used, when speed is important, or when pneumothorax is present.

- (b) An effort to do an extrapleural operation is warranted in exceptional cases. The indications are: differential pressure not available, pneumothorax not present, no injury

to the pleura such as would render the effort useless, adequate assistance, and relatively good condition of the patient. Under these conditions, a flap with pedicle outward is favorable.

(c) In some cases in which the diagnosis is in doubt, extrapleural exploratory pericardiotomy may be performed by resection of the sixth costal cartilage as in the primary incision of Kocher's flap operation.

(d) Atypical procedures are at times indicated.

7. Fine vaselined silk on a curved intestinal needle is the best material for heart suture.

8. The pericardium should be closed with interrupted cat-gut sutures.

9. Pericardial drainage may be dispensed with in some cases when there is short exposure and little trauma. A drain should enter the pericardium to a slight extent when the nature of the wound renders infection probable. But in doubtful cases it is best to insert a drain down to but not into the pericardial wound, a small part of which should be left unsutured. In this way an exit is provided for the large accumulation of serum which is likely to occur as the result of traumatic pericarditis, and no irritation of the pericardium is caused by the presence of a drain.

10. Pleural drainage is a prophylactic step which is often unnecessary and likely to be harmful. Unless there is a strong probability of infection, it is better to delay drainage until infection has occurred and then to do secondary thoracotomy.

TABULATION OF CASES OF HEART SUTURE SUPPLEMENTING PECK'S TABLE, 1909.

Borzymowski, 2 cases (*Centralblatt. f. Chirurgie*, No. 30, 1910, p. 1007): Method recommended and presumably used: skin incision down middle of sternum from third cartilage and outward along fifth. Resection of 3 cm. of third, fourth, fifth cartilages and adjacent half of sternum. Pleura is separated unopened. Heart wound sutured and stitched around with pericardium. Drainage of pericardium. One recovered, one died. Original report not accessible. (*Przeegl. Chir. i ginek.*, Warsaw, 1909, i, p. 50.) These are Borzymowski's fourth and fifth cases.

Boljarski (*Russki Vratsch*, No. 5, 1911; *Centralblatt. f. Chir.*, No. 22, 1911, p. 787): Stab wound, 2 cm. long, between fifth and sixth left ribs, external to nipple line. Male, age 27 years. Hæmopericardium. Wound of left-ventricle 5 cm. from apex. Enlargement of skin wound along ribs to 10 cm. Resection of fourth and fifth costal cartilages. Heart wound closed with three silk sutures. Pericardium and pleura entirely closed. No drainage. Left-sided pneumonia. Pericardial friction for two weeks. Recovery. (Case is No. 26 of the cardiorrhaphies in the Obuchow Hospital, St. Petersburg.)

Brewster and Robinson (*ANNALS OF SURGERY*, March, 1911, p. 324): Gunshot wound over fifth left rib mesial to nipple line. Male, age 28 years. Time between injury and operation, 6 hours. Round hole in anterior wall of left ventricle. Quadrilateral incision, division of cartilages of third, fourth, and fifth ribs, with double intercostal incision. Three catgut sutures, covered by continuous catgut. Death on table. Heart massage was ineffectual.

Brod (1904), quoted by F. Hesse: Stab wound in fifth left intercostal space just outside nipple line, 2 cm. long. Male, age 41 years. Pleura penetrated. Hæmopericardium. Time between injury and operation, 2 hours. Right ventricle, transverse wound 1 cm. Skin muscle flap, partial resection of fourth, fifth, and sixth ribs. Silk suture was applied through apex for better fixation. Silk suture of heart wound. Death on table; failure of massage.

Bufalini (1906) (*La Riforma Medica*, No. 49, 1906, p. 1357): Stab wound in mid-line; sternum pierced. Male, age 27 years. Marked hæmopericardium. Time between injury and operation, $\frac{1}{2}$ hour. Very large hole in right ventricle. Extensive flap and resection of sternum. Ten silk sutures. Small gauze drain penetrating lowermost part of pericardium; removed on third day. Pleura not drained. Course, uneventful. Recovery.

Bufalini (1908) (*La Clinica Chirurgica*, xvii, No. 3, 1909, p. 694): Stab wound in fourth left intercostal space. Male, age 27 years. Hæmopericardium. Time between injury and operation, 3 hours. Wound of right ventricle in middle of anterior surface, 1.5 cm. in length. Enlargement of wound to about 11 cm.; section of third and fourth cartilages and resection of part of sternum. Six silk sutures. Pericardium drained with iodoform gauze. Pleura not drained. Pleuritic exudate; patient up in 20 days after operation. Recovery.

Bufalini (1909) (*ibid.*): Stab wound third right interspace 1 cm. outside parasternal line, 3.5 cm. long. Male, age 21 years. Hæmopericardium. Time between injury and operation, $1\frac{1}{2}$ hours. Wound 1 cm. long, in right auricle. Enlargement of stab wound about 10 cm., exposing right margin of sternum. Section of third and fourth cartilages; partial resection of right half of sternum. Two silk sutures. Pericardium drained with iodoform gauze. Pleura not drained. Severe bronchitis. Wound healed by first intention. Recovery.

Ehrlich, cf. Ranzi.

Erdmann (*Med. Record*, vol. lxxviii, 1910, p. 1095): Stab wound,

$\frac{3}{4}$ inch long, of right chest, penetrating fifth costal cartilage. Male, age 21 years. Hæmopericardium. Time between injury and operation, 4 hours. Right ventricle. Exploratory median epigastric laparotomy; extended upward and seventh, sixth, fifth, and fourth costal cartilages divided; sternum cut across at level of fourth cartilage; 8-10 catgut sutures. Cigarette drain into pericardial cavity. Lobar pneumonia and pneumothorax. Up on fourteenth day. Recovery.

Ewald (*Wiener klin. Woch.*, No. 52, 1909, p. 1817): Two stab wounds in cardiac region, between fourth and fifth ribs. Male, age 23 years. Hæmopericardium. Stab wound in third intercostal space, penetrating pleura. Time between injury and operation, 15 minutes. Small perforation, size of lentil, in left margin of left ventricle. Incision along fourth intercostal space, from middle of sternum, about 12 cm. long. Division of fifth costal cartilage close to sternum. Resection of part of fourth rib. One silk suture of heart wound. Closure of pericardial incision with silk sutures. Pericardium drained with strip of iodoform gauze. No pleural drainage. The complicating pleural wound was not sutured. Slight serous discharge for six weeks. Mild bronchitis and pleurisy. Patient up on fifteenth day. Recovery. "Drainage should be limited to the minimum."

Ferretti (2 cases) (*Atti della Soc. Lancis degli Ospedali di Roma*; *Jahresbr. f. Chir.*, xii, 1906, p. 705): Penetrating wounds of thorax. Adult males. First case, right ventricle. Second case, left ventricle, near apex. Fontan's procedure, with modifications (osteoplastic flap with pedicle outward). Pleura not opened in second case. First case, death from acute anæmia. Second case, death, forty-ninth day, from secondary hemorrhage, after recovery from purulent pericarditis.

Flörcken (*Münch. med. Woch.*, No. 32, 1909, p. 1634): Stab wound near sternum in fourth left intercostal space, 3 cm. long. Male, age 22 years. Hæmopericardium marked. Time between injury and operation, $\frac{1}{2}$ hour. Right ventricle 2 cm. long. Flap with lateral base; resection of three ribs. Three catgut sutures. No drainage. Mild serous pericarditis. Patient up on sixteenth day. Recovery. Rubber drain was first inserted into pericardium, but was removed when seen to pulsate synchronously with the heart beats.

Foramitti (*Wiener klin. Woch.*, No. 25, 1910, p. 957): Stab wound to right of sternum. Branch of coronary artery wounded. Heart suture. Recovery. "The case is to be reported in detail."

Foederl (1909) (*Wiener klin. Woch.*, vol. xxiii, No. 25, 1910, p. 923): Gunshot wound. Male, age 19 years. Hæmopericardium. Hæmopneumothorax. No tamponade. Time between injury and operation, 2 hours. Left ventricle, 4 cm. above apex. Flap with left-sided base. Suture of heart. Pericardium and pleura washed with salt solution and sutured. No drainage. Uneventful course. Recovery. According to post-operative X-ray, bullet lay near apex.

Foederl (1903) (*ibid.*): Two stab wounds, one above, the other below the fourth rib. Male, age 25 years. Symptoms of progressive hæmopericardium. Pleura intact. Left ventricle, 1 cm. Flap of third and fourth cartilages, without injury to the pleura. Two sutures. Drain-

age of pericardium with gauze. Protracted course; thoracotomy. Recovery. Patient well at time of report, seven years after operation.

Foederl (1907) (*ibid.*): Gunshot wound in nipple line, fifth intercostal space. Male, age 22 years. Complicating injury, gunshot wound in right temporal region. Time between injury and operation, several hours. Wound 5 mm. in diameter anterior wall of left ventricle, 3 cm. from apex. Exit wound posterior wall. Flap 4 fingers' width. Suture of heart wounds. Death after half an hour. Failure of heart massage, salt infusion, artificial respiration.

Friedrich (*Münch. med. Woch.*, No. 4, 1909, p. 210): Stab wound in fifth intercostal space. Adult male. Pneumothorax. Right ventricle. Under differential pressure (Brauer). Flap of soft parts with base at sternum; resection of 10 cm. of fifth rib. Three silk sutures. No drainage. Uncomplicated. Recovery.

Fuchsig (*Centralblatt f. Chir. Beilage*, No. 29, 1911, p. 67): Stab wound of thorax. Perforation of diaphragm. Right ventricle. Suture of heart proved possible through the slit in the diaphragm. Recovery.

Grisogono (*Wiener klin. Woch.*, No. 25, 1910, p. 924): Stab wound in third intercostal space, 3 fingers' breadth from mammary line, 1.5 cm. in length. Male, age 18 years. Pneumothorax; hæmopericardium without signs. Time between injury and operation, $\frac{3}{4}$ hour. Wound 1.5 cm. long, left auricle. Triangular skin-muscle flap. Resection of third and fourth cartilages for 7 cm. from sternum and 5 cm. of second. Four silk sutures. Pleural cavity drained with gauze through lower angle of wound. Pericardium, no drainage. Pneumothorax. Slow recovery; discharged well two and a half months after operation. A year later practically normal.

Guetig (*Wiener med. Woch.*, No. 43, 1910, p. 2543): Stab wound, 3 cm. long, two fingers' width outside of and below left nipple. Male, age 40 years. Time between injury and operation, $\frac{1}{2}$ hour. Right ventricle, oblique wound, 3 cm. Skin-muscle flap with lateral base, division of fourth and fifth cartilages at sternum; division of cartilages of lower ribs. Interrupted silk sutures. Death on table, after transitory resuscitation of heart by injection of salt solution into left ventricle. Autopsy showed that the heart had been entirely perforated by the knife; tricuspid valve injured; exit orifice 1 cm.

Guidone (*Policlinico Sez. Prat.*, vol. xvi, Fasc. 36, 1909, p. 1135): Stab wound of thorax, 1.5 cm. long. Male, age 18 years. Operation soon after injury. Wound of right ventricle. Resection of sternum and fifth, sixth, and seventh costal cartilages. Five interrupted sutures. Pericardium drained. Recovery.

Guinard (*Bull. et Mem. Soc. de Chir. de Paris*, vol. xxxvi, 1910, p. 162): Gunshot wound, third interspace, 1 cm. internal to nipple line. Male, age 13 years. Hæmothorax, 1½ litres. No signs of cardiac injury. Symptoms of progressive internal hemorrhage. Two holes in base of heart. Three catgut sutures to each wound. No trace of blood in pericardium; it gushed directly into the pleura. No drainage. Emphysema. Death three hours after operation.

Heinrichsen (*St. Petersburger Mediz. Wchschrft.*, No. 45, 1910, p.

632): Stab wound at level of left second rib between margin of sternum and axillary line. Injury to lung. Time between injury and operation, 3 hours. Left ventricle 1 cm. Enlargement of wound, resection of third and fourth ribs. Suture of heart, pericardium, and pleura. Death on second day due to simultaneous injury of lung which had been overlooked.

Heinrichsen (*ibid.*): Stab wound in third intercostal space, mammary line. Right ventricle through entire wall, 1.5 cm. long. Enlargement of wound, resection of third, fourth, and fifth costal cartilages. Suture of heart, pericardium, and pleura. Purulent pericarditis. Death on twenty-first day.

Heller, quoted by F. Hesse: Stab wound, 5 cm., in fifth intercostal space external to nipple. Male, age 22 years. Hæmopneumothorax. Hæmopericardium. Time between injury and operation, one hour. Left ventricle a few centimetres above apex. Triangular flap, with division of fifth, fourth, and third ribs. Resection of sixth rib. Four silk sutures. Pericardium drained. Pleural cavity drained with large tubes. Much serous discharge. Death on third day.

Houzel (*Gazette des Hopitaux*, No. 3, 1911, p. 32): Stab wound, 6 cm., left nipple. Male, age 32 years. Over one hour before operation. Auriculoventricular wound, exposing mitral valve, 5 cm. long. Five catgut sutures. No drainage. Heart stopped a few seconds after application of the last suture. Revived, after 12 seconds, by cardiac massage. Two litres of hot serum poured into thoracic cavity. Death 17 hours later.

The following 21 cases operated at Obuchow Hospital, St. Petersburg:

E. Hesse (1905) (*Beitr. z. klin. Chirurgie*, vol. lxxv, H. 3, 1911, p. 475): Stab wound 3 cm. long, parasternal line, fifth intercostal space. Male, age 19 years. Heart tamponade. Time between injury and operation, 1 hour. Penetrating wound of right ventricle. Flap incision along left sternal margin and fifth rib, base above, resection of sternal segments of fourth, fifth, sixth, and seventh ribs. Three sutures. Drainage of pericardium. Drainage of pleura through wound. Change of dressings on fifth day; tampons soaked. Recovery. Well five years after the operation, with full working capacity.

Ibid. (1906): Stab wound, 1.5 cm. long, in left third intercostal space, anterior axillary line. Male, age 19 years. Wound of lung near base. Time between injury and operation unknown. Wound 1.5 cm. long in anterior surface of left ventricle about two fingers' width from apex. Incision along third rib; resection of 6 cm. of third rib. Application of heart sutures. Death on table.

Ibid. (1906): Stab wound, 2 cm. long, on third rib, 2 fingers' width to left of sternum. Male, age 19 years. Time between injury and operation, 6 hours. Small wound of right atrium. Triangular skin-muscle flap. Resection of fourth and third costal cartilages and part of sternum. Three sutures. Drainage of pericardium. Death 42 hours after operation, acute anæmia.

Ibid. (1907): Stab wound between seventh and eighth left ribs. Male, age 20 years. Time between injury and operation, a few hours. Wound of left ventricle near apex, 1 cm. long. Resection of seventh and eighth ribs. Three silk sutures. Pericardium drained with gauze. Pleural cavity drained with gauze. Empyema. Death on eighth day.

Ibid. (1906): Gunshot wound, in third intercostal space, left nipple line. Male, age 31 years. Hæmopericardium. Operation soon after injury. Left ventricle was obliquely opened, part of myocardium torn away. Sutures were applied deeply, but always tore out. Symptoms of progressive heart failure. Death in 24 hours.

Ibid.: Stab wound over left fifth rib between nipple and parasternal lines, 4 cm. long. Male, age 23 years; exsanguinated. Pleura penetrated. Hæmopericardium. Penetrating wound of left auricle, wound 3-4 cm. long. Six sutures. Death on table.

Ibid. (1907): Stab wound in left nipple line between fifth and sixth ribs. Male, age 17 years. Pericardium filled with fluid blood. Immediate operation. Left ventricle 3 cm. long. Enlargement of wound along sixth rib, which was resected for about 10 cm. Second vertical incision, resection of fourth and fifth ribs, extent of 5 cm. Seven sutures. Pericardium drained. Lung was fixed to thoracic wall. Pneumonia and empyema. Death on fifth day.

Ibid. (1907): Three stab wounds, 2-3 cm., near sternum in region of fifth rib. Male, age 23 years. Stab wound opening abdominal cavity. Right ventricle 5 cm. Incision across sternum, along fifth rib, resection of rib. Four sutures. Death on table, after resuscitation by injection of salt solution into left ventricle.

Ibid. (1907): Stab wound between fifth and sixth rib, in left anterior axillary line. Male, age 15 years. Left ventricle, at left margin, near apex, 1.5 cm. Enlargement of wound, partial resection of fourth and fifth ribs with cartilages. Four sutures. Suture of pleura. Pericardium drained with gauze. Death on third day. Acute anæmia.

Ibid. (1908): Stab wound 2 cm. long, between fourth and fifth costal cartilages, 1½ fingers' width to left of sternum. Male, age 21 years. Stab wound of abdomen, viscera uninjured. Time between injury and operation, 1½ hours. Right ventricle, 1 cm. Skin-muscle flap, resection of cartilages of fifth and sixth ribs. Two deep sutures. Pericardium and pleura closed. No drainage. Pneumonia on fifth day. Empyema, thoracotomy on eighth day. Obstinate septic diarrhœa on twelfth day. Dry pericarditis on fifteenth day. Improvement began fifth week. Discharged, in good condition, in eleven weeks. Well two and a half years after operation.

Ibid. (1908): Stab wound, 3.5 cm., near sternum, over second right rib. Male, age 19 years. Right ventricle, 1.5 cm. Resection of second, third, and fourth costal cartilages and part of sternum. Six silk sutures. Pericardium drained. Bilateral pneumonia, left-sided empyema, purulent pericarditis. Death twenty-fifth day.

Ibid. (1909): Gunshot wound between fourth and fifth ribs, 2 fingers' width to right of nipple. Exit orifice about four fingers' width below

left scapular angle. Male, age 17 years. Wound of left lung. Time between injury and operation, $1\frac{1}{2}$ hours. Left ventricle. Resection of fourth and fifth ribs with cartilages, about 7 cm. Three sutures. Suture of lung wound, pericardium, and pleura. No drainage. Left-sided empyema; thoracotomy. Pericarditis sicca. Right-sided dry pleurisy. Recovery. Two years later, in good health. Radiograph showed presence of adhesions.

Ibid. (1909): Stab wound, 2 cm. above and to right of left nipple. Male, age 28 years. Injury of branches of coronary artery. Time between injury and operation, 4 hours. Left ventricle, anterior surface near apex, 1 cm. Resection of fourth rib. Two sutures. Suture of pericardium and pleura. No drainage. Recovery. Eighteen months after operation good health; slight systolic retraction in the cicatrix.

Ibid. (1909): Stab wound, 2 cm. in anterior axillary line between fifth and sixth ribs. Male, age 20 years. Penetrating lung wound. Left ventricle. Resection of fifth rib. Heart sutures cut through. Pericardium was stitched with heart wound. Pericardial attachment then detached from pericardium and pericardium closed. Lung sutured. Death soon after operation.

Ibid. (1910): Stab wound at right sternal margin, over fifth rib. Walked to hospital. Profuse bleeding. Male, age 17 years. Right auricle, 0.5 cm. long, just below entrance of vena cava. Resection of fifth and sixth ribs to extent of 4-5 cm. Four sutures. Closure of pericardium. Partial closure of pleura. Control of pneumothorax by means of Potain apparatus. Death in 17 hours. Symptoms of progressive heart failure.

Ibid. (1910): Stab wound about 1.5 cm. long, between fifth and sixth ribs, left side, between nipple and anterior axillary line. Male, age 27 years. Time between injury and operation, $1\frac{3}{4}$ hours. Left ventricle, 2 cm. long about 5 cm. from cardiac apex. Resection of fourth and fifth ribs, to extent of 6-7 cm. from sternum. Three sutures. Suture of pericardium and pleura. No drainage. Left-sided pneumonia, on fourteenth day. Well on twenty-fifth day. Re-examined 8 months after operation, condition good.

The following five cases have been published in a Russian journal, 1904:

Ibid. (1903): Stab wound 1.5 cm. long in second intercostal space, about $2\frac{1}{2}$ fingers' width from left sternal margin. Female, age 25 years. Time between injury and operation, 3 hours. Left ventricle 0.5 cm. Skin-muscle flap, resection of third and fourth cartilages. One suture. Pericardium and pleura sutured. No drainage. Recovery. Ten and a half months later, in good health. Re-admitted 7 years after operation, no disturbance of heart, systolic retraction of cicatrix.

Ibid. (1903): Stab wound 1.5 cm. long in fourth intercostal space, about $1\frac{1}{2}$ fingers' width to left of left nipple. Female, age 30 years. Complicating injury, fracture of skull. Time between injury and operation, 5 hours. Wound about 1.5 cm. long, anterior wall of right ventricle,

close to anterior branch of coronary artery. Skin-muscle flap. Resection of third, fourth, and fifth ribs. Two sutures. Suture of pericardium and pleura. Pleura drained with gauze through wound. Death in 54 hours. Autopsy showed signs of incipient fibrinous pericarditis and pleurisy, chronic nephritis, and a large cranial fissure.

Ibid. (1903): Stab wound 1.5 cm. long in second intercostal space, 1.5 cm. to left of sternal margin. Female, age 22 years. Time between injury and operation, 4½ hours. Right ventricle, 1.5 cm. near septum, 2½ fingers' width from cardiac apex. Flap of third, fourth, and fifth costal cartilages, division of sixth rib at sternal insertion. Five sutures. Suture of pericardium and pleura. No drainage. Steadily rising temperature and dyspnoea. Resection of ninth rib; escape of bloody fluid and clots. Signs of exudative pericarditis. Death on fourteenth day. Autopsy showed that heart wound had completely healed so that the sutures could only be discovered with difficulty.

Ibid. (1903): Stab wound 3.5 cm. long in fourth intercostal space in left parasternal line. Female, age 53 years. Irregular stellate wound in left ventricle, diameter about 2.5 cm. Resection of cartilage and bone of fifth rib, and cartilage of fourth rib, close to sternum. Seven sutures. Death on table. Heart massage unsuccessful.

Ibid. (1904): Stab wound, 1 cm. long, in fourth intercostal space, at right sternal margin. Female, age 35 years. Time between injury and operation, 1 hour. Two transverse wounds of right auricle, about 0.5 cm. long, one below the other. Flap, lateral pedicle of fourth, fifth, and sixth cartilages. Closure of upper heart wound, 1 suture; lower heart wound, 2 sutures. Drainage of pleural cavity, through wound. Death 29 hours after operation.

F. Hesse (1908) (*Archiv f. klin. Chir.*, vol. xcv, H. 4, 1911): Gun-shot wound, third left intercostal space, 2 cm. inside nipple line. Male, age 15 years. Hæmopericardium. Time between injury and operation, 1½ hours. Middle of left ventricle 2 cm. to right of margin, orifices on anterior and posterior surfaces. Skin-muscle bone flap base medial including third and fourth cartilages. One and two silk sutures. Rubber drain in pericardium. Two drainage tubes in pleural cavity, scapular line, by resection of rib. Death in seven hours. Heart stopped during the operation; massage failed; injection of camphor 0.75 cm. 20 per cent. solution into heart muscle effective.

F. Hesse, *ibid.* (1909): Stab wound, 1 cm. in length in third left intercostal space, 4 fingers' width from sternum. Male, age 35 years. Time between injury and operation, nearly 3 hours. Left auricle 0.75 cm. long. Resection of ribs and cartilages, also a strip of sternum. Effort to do extrapleural operation failed. Three silk sutures. Large rubber drainage tube into pericardium. Two drainage tubes into pleural cavity in scapular line by resection of rib. Discharge from pleural cavity profuse, from pericardial cavity slight, so that drain was removed on fifth day. Pleural drain left for a month. Recovery. Two years later slight systolic retraction in fifth intercostal space, within nipple line.

F. Hesse, *ibid.* (1909): Stab wound 1 cm. long in third left inter-

costal space near sternum. Male, age 24 years. Pronounced tamponade. Time between injury and operation, $2\frac{1}{2}$ hours. Left auricle, 0.75 cm. Flap with external pedicle of third and fourth cartilages and part of ribs; resection of half of adjacent sternum; section of fifth rib. Pleura opened. Three silk sutures. No drainage. Recovery. Two years later complained of pain after exertion. Distinct systolic retraction in fifth intercostal space.

F. Hesse, *ibid.* (1909): Stab wound, 2.5 cm. long, under left nipple, in fourth intercostal space. Male, age 17 years. Hæmopneumothorax. Time between injury and operation, 3 hours. Left ventricle a little below atrioventricular boundary. Resection of fourth rib from nipple to sternum; opening of pleura to this extent. Five silk sutures. Removal of clots from pleural cavity. No drainage. Pleurisy and pneumonia. Entire wound opened and healed gradually. Recovery. Ten months later free from any disturbance due to the injury.

Iselin (*Deutsch. Ztschrft. f. Chir.*, vol. cv, 1910, p. 572): Gunshot wound, in fourth intercostal space, mesial to nipple. Female, age 20 years. Small wounds in lung. Hæmothorax. Hæmopericardium. Time between injury and operation, $1\frac{3}{4}$ hours. Small hole in left ventricle, nearer to base than apex. Exit orifice posteriorly, a little larger. Intercostal incision in fourth space beyond anterior axillary line. Suture of both heart wounds with catgut. Suture of lung wounds. Suture of pericardium and pleura after removal of clots. No drainage. Moderate symptoms of pericarditis and pleurisy. Recovery.

Einar Key (*Hadar Liden Hygeia*, vol. lxxi, 1909, p. 1249): Gunshot wound of epigastrium. Boy, age 10 years. Operation 1 hour after injury. Oval wound 1 cm. long in anterior surface of right ventricle, near apex. Incision through wound in epigastric angle, upward through sternal ends of sixth, to fourth left costal cartilages; transverse incision in sixth intercostal space, forming a thoracic flap with its base above. Closure of heart wound with interrupted catgut sutures. Pericardium drained with small tampon which was removed on next day. Drainage of pleural cavity. Empyema. Recovery. Radiograph showed bullet in left wall of thorax.

Kirchner (*Southern Surg. and Gyn. Transactions*, xxii, 1909, p. 171): Two stab wounds in fifth and sixth intercostal spaces about $\frac{1}{2}$ inch in length. Male, age 37 years. Pericardium contained fluid blood. Left ventricle, $\frac{3}{4}$ inch, near apex. Osteoplastic flap with mesial pedicle at sternum, division of sixth rib. Eight silk sutures. Gauze drain in pericardium. Pleural cavity drained with rubber tube. Death four hours after operation. Autopsy showed another small wound in left ventricle.

Kirchner (*ibid.*): Stab wound $\frac{3}{4}$ inch, in fifth intercostal space. Male, age 24 years. Time between injury and operation, $\frac{1}{2}$ hour. Left ventricle, $1\frac{3}{4}$ inches long, 1 inch from apex. Osteoplastic flap, pedicle at sternum. Three deep chromic catgut sutures. Seven intermediate sutures required to control hemorrhage. Two supporting mattress sutures. Rubber drain in pericardium. Pneumonia. Recovery.

Leischner, cf. Ranzi.

McCabe (*Southern Med. Journal*, 1910, p. 540): Stab wound in fourth intercostal space. Female, age 18 years. Time between injury and operation, 2 hours. Right ventricle near centre. Enlargement of original wound, division of fourth costal cartilage. Catgut sutures. Drainage tube into pericardium. Pneumothorax and pneumonia. Death on seventh day.

Magenau (*Beitr. z. klin. Chir.*, vol. lxix, 1910): Gunshot wound slightly mesial to nipple. Male, age 28 years. Hæmothorax. Hæmopericardium. Time between injury and operation, 2 hours. Left ventricle circular wound 1 cm. in diameter, 3 fingers' width above apex. Oval wound on posterior surface. Resection of segments of sixth, fifth, and fourth ribs. Three sutures of linen for each wound. No drainage. Second day pulse gradually disappeared. Pericardium was opened, and much turbid serous exudate escaped. Pulse returned, but patient died suddenly.

Neugebauer (*Münch. med. Woch.*, No. 1, 1909, p. 25): Stab wound 1.5 cm. long above left third costal cartilage near sternal margin. Male, age 21 years. Hæmopericardium. Time between injury and operation, 6 hours. Pericardium was aspirated $\frac{1}{2}$ hour after admission; temporary relief. Right ventricle middle of anterior wall, 1.5 cm. Flap of third, fourth, and fifth left costal cartilages. Removal of half of adjacent sternum. Five silk sutures. Pericardium drained. Change of dressings on second day; escape of large quantity of clear serum, synchronous with heart beats; continued discharge of clear serum for several days. Recovery. Well two months after discharge, heart normal.

Pikin (*Archiv f. klin. Chir.*, vol. xcv, 1911): Stab wounds with scissors, in thoracic region. Female, age 23 years. Wounds of both lungs, liver and diaphragm. Hæmopneumothorax. Left auricle 1.25 cm. Enlargement of pericardial wound to 6 cm. Closure of heart wound with 2 silk sutures. Closure of pericardium with interrupted catgut suture. No drainage. Bilateral serous pleuritis. Recovery.

Pool: Stab wound, $\frac{1}{2}$ inch long, fourth intercostal space just mesial to nipple. Male, 24 years old. Pleural cavity penetrated by knife. Operation less than 1 hour after injury. Left ventricle at margin, $\frac{1}{2}$ inch long, $1\frac{1}{2}$ inches above apex. Flap with lateral pedicle, including third and fourth costal cartilages; section of fifth cartilage. Five vaselined silk sutures in heart wound. Pericardium closed with interrupted catgut, leaving space at lowermost part for drainage. Rubber tissue drain to but not into pericardial wound at lower mesial angle of wound. Free serous discharge for seven days. Up on eighteenth day, discharged on twenty-fifth day. Recovery.

Proust, Bloch, de Cumont. (*Bull. d. l. Societe Anat. de Paris*, vol. lxxxv, 1910, p. 635): Gunshot wound, mesial to left nipple; fifth costal cartilage fractured by bullet. Boy, age 13 years. Pleura opened. Pericardium filled with clots. Time between injury and operation, 6 hours. Left ventricle near apex. Flap formation, division of fourth to sixth cartilages at sternal insertion; four sutures. Very small drain into pericardium. High temperature. Symptoms of pericardial effusion

second week. Nothing drained from tube, which was drawn out, and a large quantity of bloody serous fluid escaped; improvement; temperature normal in less than 48 hours. Patient discharged well one month after operation. Seen two months later in good health.

Ranzi (*Wiener klin. Woch.*, No. 50, 1911, p. 1729): Two gunshot wounds over fifth and sixth left ribs mesial to nipple. Male, 24 years old. Hæmothorax. Time between injury and operation, 5 hours. Left ventricle anterior surface near apex; no exit wound found. Schoenmaker's hyperpressure apparatus used. Skin-muscle flap, resection of fourth and fifth cartilages. Several sutures. No drainage. Empyema; posterior thoracotomy. Recovery.

The following 3 cases, previously unpublished, were likewise operated on in V. Eiselsberg's Clinic.

Ranzi (*ibid.*): Stab wound above left nipple. Female, 20 years old. Moribund. Hæmopericardium. Time between injury and operation, 40 minutes. Left ventricle 1 cm. Sauerbruch's cabinet. Resection of 8 cm. fifth and sixth ribs. Six sutures. No anæsthesia. Death on table.

Leischner (*ibid.*): Gunshot wound 2 fingers' width mesial and below left nipple. Male, 17 years old. Hæmothorax. Two wounds of lung. Time between injury and operation, 1 hour. Near septum 2 fingers' width above apex. Sauerbruch's cabinet. Skin-muscle flap. Resection of fourth and fifth ribs. Three sutures. Lung wounds sutured. Camphor and adrenalin injections into left ventricle. No drainage. Cough with hæmoptysis. Death on second day.

Ehrlich (*ibid.*): Stab wound below and mesial to left nipple. Hæmopericardium marked. Operation 45 minutes after injury. Anterior wall of right ventricle, 2 wounds. Resection of 4 cm. of fourth and fifth ribs. Eversion of third cartilage. Suture of heart wounds. No drainage. Death on day after operation. Autopsy showed another wound on posterior surface of left ventricle.

Rassieur (1903) (*J. Missouri Med. Assoc.*, St. Louis, 1910, vol. vi, p. 316): Gunshot wound in fourth space just below and internal to left nipple. Male, age 20 years. Left lung wounded in lower lobe. Hæmothorax. Time between injury and operation, 3 hours. Left ventricle, ragged laceration midway between base and apex. Resection of one inch of fourth and fifth ribs at costochondral junction. Three silk sutures. Repair of wound of lung. No drainage of pericardium. Gauze drain in pleural cavity. Late secondary abscess. Recovery.

Renner (*Deutsch. med. Woch.*, No. 10, 1910, p. 456): Two stab wounds, one in fifth intercostal space, 3 cm. long, one in sixth intercostal space, 8 cm. long. Male, age 32 years. Wound involved pleura, diaphragm, and peritoneum. Operation $\frac{1}{2}$ hour after injury. Left ventricle 2 cm. long. Flap of third, fourth, fifth, and sixth ribs. Four silk sutures. Suture of diaphragm. Pericardium and pleura drained with rubber tubes. During first days, profuse serous secretion. Pericardial drain removed on ninth day; pleural drain on thirteenth day. Recovery. Patient in good condition nine months later. Renner recommends extensive drainage with tubes.

Schmerz (*Mittlg. d. Vereins der Aertze in Steiermark*, Nov., 1911,

p. 415): Stab wound 2 cm. long in fourth space at upper margin of fifth rib near sternum. Male, age 21 years. Pleura opened. Operation soon after injury. Right ventricle 2 cm. Skin-muscle flap. Fourth and fifth ribs with cartilages resected 7 cm. Four silk sutures. Pericardial and pleural cavities flushed with salt solution. Lower margin of lung sutured into pleural wound. Gauze drain to pericardial suture. No pleural drainage. Serous pleuritic exudate, twice tapped. Free serous discharge from drainage opening. Recovery.

Schnitzler (*Wiener med. Woch.*, No. 7, 1910, p. 386): Stab wound near left nipple, 1.5 cm. long. Male, age 16 years. Left pleura opened by weapon. Time between injury and operation, $\frac{3}{4}$ hour. Right ventricle near septum about middle of anterior wall 1 cm. long. Removal of 3 cm. of fourth and fifth costal cartilages. Four silk sutures. Pericardium not drained. Gauze and drainage tube into pleural cavity. (Pleura could not be closed on account of tension.) Left-sided hæmopneumothorax. Right-sided pneumonia. Recovery. Schnitzler mentions, without details, two unsuccessful cardiorrhaphies in his experience.

Schoenborn (1903), quoted by F. Hesse: Stab wound in sixth left intercostal space, 0.5 cm. long. Adult male. Pericardium contained masses of fluid blood and clots. Operation a few hours after injury. Left ventricle. Partial resection of sixth rib. Triangular flap, resection of cartilages and segments of fifth, fourth, and third ribs. Pleura accidentally opened. Four catgut sutures. Drainage of pericardium and pleural cavity. Death on second day. Autopsy showed that the catgut sutures were already so loose that they would probably have given way. No hemorrhage.

Schoemaker (*Monatsschrift f. Unfallheilkd.*, vol. xvi, 1909, p. 225): Stab wound 2 cm. long, close to sternum, over cartilage of sixth left rib. Male, age 26 years. Hæmopericardium. Operation 2 hours after injury. Right auricle. Triangular flap; 5 cm. of sixth cartilage removed; vertical incision along edge of sternum 6 cm. long, dividing fifth and fourth cartilages. Three catgut sutures. Pleura sutured. Pericardium drained with gauze. Removal of drain on third day was followed by large quantity of clear serum, which ceased two days later. Recovery.

Tavel (1909), quoted by König (*Deutsch. Zeitschrift. f. Chir.*, Bd. cxii, H. 4-6, 1911, p. 490): Stab wound, fifth intercostal space, 2 fingers' width outside mammary line, 1.5 cm. Male, 22 years old. No increase in cardiac dulness. Pleura penetrated but no signs of hæmothorax. Time between injury and operation $1\frac{1}{2}$ hours. Apex 1.5 cm. long. Flap with mesial base of fourth, fifth, and sixth cartilages and ribs which were divided 2 fingers' breadth external to mammary line. Three catgut sutures. Suture of pleura. Gauze drain to pleura suture. Pericarditic friction. Bronchopneumonia. Up in 4 weeks. Recovery.

Torre, de la Ortiz (*Rev. d. Med. y. Cir. pract. de Madrid*, 1908; *Centralblatt f. Chir.*, No. 49, 1908, p. 1488): Wound in fourth intercostal space, 2 cm. Adult male. Right auricle contained an imbedded piece of glass. Flap of 10 cm. of fourth, fifth, and sixth ribs. Catgut suture. Rise of temperature on fifth day. Evacuation of 700 Gm. of fluid, by puncture. Recovery.

Trendelenburg (Rimann, *Münch. med. Woch.*, No. 15, 1909, p. 760): Gunshot wound, in fourth left intercostal space. Male, age 20 years. Pericardium contained 100 c.c. of fluid and clotted blood. Time between injury and operation about 1¼ hours. Left ventricle, small hole in lower half. No exit orifice found. Longitudinal incision on fifth rib, resection of fourth and fifth costal cartilages. Five silk sutures. Excision of gunshot wound in skin. No drainage. Course favorable. Recovery.

Walther (*Protokolle d. Wissenschft. Veriens der Aerzte des Städtischen Obuchow Krankenhauses*, St. Petersburg, Nov. 13, 1909): Stab wound in cardiac region. Right ventricle. Heart suture. Recovery. Death from cardiac insufficiency three years and eight months after the operation. Autopsy: Extensive cardiopericardial adhesions. Heart wall very thin in region of cicatrix. No aneurism.

Wesselowsorow (*K. Kaukasian Med. Gesellscht.*, 1910; quoted by E. Hesse, *Beitr. z. klin. Chir.*, 75, 1911): Heart suture. Recovery.

E. Rychlik: Herzverletzung (*Sbornik klinicky*, 1911, xii [xvii], Nr. 3 u. 4) (*Zentralblatt für Chirurgie*, No. 6, Feb. 10, 1912, p. 206): The author reports five cases of wound of the left ventricle.

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PNEUMECTOMY: ITS POSSIBILITIES.

REPORT OF A CASE OF PARTIAL LUNG EXCISION.

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IF the operative removal of portions of the lung should become a procedure attended with reasonable hope of success, certain chronic pulmonary lesions might come to be regarded less as incurable. Malignant growths, actinomycosis, bronchiectasis, chronic interstitial pneumonitis belong to this obstinate group, and certain selected cases of advanced tuberculosis may also be included. Diseases of like gravity in other organs of the body are regarded as within the scope of surgical relief; but the operative results in these chronic thoracic diseases are by no means brilliant. Some fatal attempts have been reported, many others doubtless have not been, and a few successes are on record—too few, however, to indicate that surgical treatment is any more successful than palliative medicinal treatment in these so-called incurable pulmonary diseases.

HEIDENHAIN in 1898 reported a successful removal of the left lower lobe for bronchiectasis. Two previous operations had been performed with drainage of several large bronchiectatic cavities. Rib resection had been performed at each of the preliminary operations. The conditions under which the final excision was performed were strikingly similar to those of the case reported in this paper.

LOWSON in 1893 described the successful removal of a tuberculous lung apex the size of "half a fist." TUFFIER in 1891 delivered a lung apex through an intercostal incision and removed a portion of it. DOYEN in 1898 resected the remains of a right lower lobe in which a large hydatid cyst had previously been drained.

PROFESSOR GARRÉ of Bonn stated to me in 1908 that he had excised a lower lobe for bronchiectasis by first resecting a sufficient number of ribs to cause a caving in of the chest wall sufficient to permit of the delivery of the lobe and the extrathoracic treatment of the stump at a subsequent operation.

BREWER in Keen's "Surgery" illustrates a case from the private clinic of Leonard Freeman, in which a gangrenous lower lobe had been excised previous to a complete Schede operation for empyema.

RICHARDS, FORDE, HALL, and GRINNELL, 1837-1880, publish four cases of hernia of portions of the lung resulting from the withdrawal of grass-cutting tools, spears, arrows, etc. In each case the protruding lung tissue was ligated outside the thorax and the wounds sutured. Complete recovery occurred in each case.

The case of HELFERICH reported by Gerulanos has been frequently cited in connection with lung excision because two lobes were amputated. Death occurred in 24 hours, however, and it is questionable if the case should even be recorded as evidence that such an operation is technically possible.

In view of this limited number of successful cases reported, it is not surprising that lung excision is commonly regarded as an unwarranted risk. And yet a careful consideration of the apparent obstacles to success and possible means of overcoming them leads me to the conclusion that lung excision will eventually justify its existence as an operative risk.

Were fatalities previous to 1904 due to operative pneumothorax, the effects of which at that time were not overcome by the use of differential pressure? It is indeed disappointing that the general adoption of positive and negative pressure and intratracheal insufflation is not yet attended by better results in lung excisions in human beings. Differential pressure has, to be sure, rendered possible all thoracic operations in certain animals susceptible to pneumothorax. There has thus developed extensive experimental investigation concerning the technic of thoracic operations. Lung excision in dogs is attended with almost surety of success.

Yet despite the arrival of differential pressure eight years ago, the medical literature is still devoid of reported successful lung excisions for chronic disease.

From this we may conclude that the operative pneumothorax has never been the sole obstacle to success in this group of chest cases, and that we must look elsewhere for the real causes of failure.

The solution of the problem seems to rest in the fact that the pathological changes coincident with these pulmonary

diseases, in which excision would seem to be indicated, are in themselves added obstacles to the removal of the diseased lung.

In the first place, the patients affected with these chronic ailments are either cachectic from progressive malignant disease, or reduced by prolonged inflammatory processes. In such cases other organs of the body are rarely wholly normal in function. Amyloid changes may be coincident and albuminuria is generally present.

Prolonged illness, loss of weight, and a greater or less degree of toxæmia have furthermore lowered the resistance of such patients to operative injury to nerve endings. Such nerve trauma is greater in thoracic than in abdominal operations. Extensive rib resection is a preliminary shock. Irritation of the vagus terminals of the pleura is constant throughout the operation, not only from necessary retraction of a rigid wound, but from traction on lobes of the lung resulting in a stretching of the reflected pleura around the hilus. Direct contact with the pneumogastric or phrenic nerve not infrequently occurs in the approach to lesions adjacent to or within the mediastinum. Ample evidence is further presented that sudden changes in temperature, to which more or less of the pleural cavity is suddenly exposed at operation, produce shock. Even though the atmospheric air be warmed to body temperature, the respiratory excursions in the presence of open pneumothorax result in a rushing of air in and out of the pleural cavity whenever the wound opening is partially obstructed. The heat loss from the radiating pleura is in itself an additional factor in lowering the patient's resistance to shock.

In most chronic pulmonary affections, especially bronchiectasis, abundant sputum is present. The presence of such encountered at the time of operation has always been regarded as a danger, on the ground that if accumulating to the level of the bifurcation of the trachea, purulent secretions may be inhaled to the sound lung to implant subsequent infection.

I have come to regard aspiration infection after operation as an even greater danger.

If all the diseased secreting portions of the lung could be removed or isolated at the first thoracotomy, the dangers of subsequent accumulations would be obviously eradicated. A radical one-stage operation is necessary to accomplish this, even under the most favorable circumstances. It is a disputable question whether the excision of even one lobe should be done at one sitting, and if the bronchus is not drained at the first operation the sputum will continue to accumulate proximally. It is a commonly accepted fact that after any operation for suppurative intrapulmonary processes sputum ceases for from 24 to 60 hours. In the interim, coughing and expectoration are prohibited by pain produced in the thoracic wound. The presence of closed or drained pneumothorax diminishes the expulsive power of the chest wall against the lung. As a result of these post-operative conditions, the purulent secretions remain stagnant. A rattling in the trachea eventually shows that the mucopus has reached a level which permits inhalation to the opposite main bronchus.

This retention of sputum results in a rise in temperature from septic absorption. The chances of lymphatic or hæmogenous extension of infection are increased. The blocking of the main bronchus incapacitates the aerating surface of the remaining lobe or lobes of the operated side. A varying amount of cyanosis results. Although patients in this desperate predicament will sometimes accumulate strength to expel the sputum, this secretion complication is indeed an important element in determining the end result of chest operations for inflammatory pulmonary disease. That we may yet develop means of obviating it is probable; but I am of the opinion that retention of sputum alone has often led to fatalities, either directly by obstruction or indirectly through toxæmia and remote metastatic abscess formation.

Another conspicuous contrast in human thoracic operations to those upon the dog is to be found in the adhesions ever present in these chronic pulmonary diseases. The ap-

proach to the hilus of a single lobe is invariably made difficult by tough adhesions to the parietal pleura, pericardium, or adjacent lobe. The separation of these is generally attended by evidences of shock from nerve stimulation. Hemorrhage is almost inevitable as a result of the often necessary lacerations of the lung parenchyma. In other words, the mere preparation of a given portion of the lung for excision is in these chronic cases a major procedure. The extensive rib resection commonly preceding it has already produced shock; and by the time adhesions have been separated and the vessels at the hilus have been exposed, the resistance of the patient has been seriously lowered.

We have mentioned above that the immediate effects of operative pneumothorax, undoubtedly a danger to certain individuals, is obviated by the modern use of methods to maintain oxygenation in spite of partial or complete lung collapse.

Post-operative pneumothorax, on the contrary, is unquestionably a hindering factor, and has doubtless had more to do with fatalities than is generally supposed.

Although even total pneumectomy is generally successful in normal animals operated upon under differential pressure, such has been the truth only when the thoracotomy wound has been closed tightly with a considerable degree of negative pressure established in the emptied pleural cavity previously or immediately subsequent to closure. Animals left with leaking wounds have rarely recovered, and the establishing of a definite drainage immediately after a clean operation will invariably result fatally.

Excision of a lobe of the lung for pulmonary disease in the human being with immediate permanent closure of the chest wall opening has never been successfully performed, and it is doubtful if such technic will ever be justifiable. Hemorrhage from separated adhesions is rarely entirely arrested, and the drainage of such ideal culture medium is generally indicated. Trauma to the diseased lobe in the process of freeing adhesions doubtless releases infection. Amputation of an infected lobe, unless under ideal conditions, must further

introduce bacteria to the pleural cavity. In other words, drainage must generally be established.

A closed or partially open post-operative pneumothorax is the necessary accompaniment of drainage. The effects of post-operative pneumothorax depend somewhat upon the degree of fixation of the remaining organs bounding the persisting pleural space. If the remaining lobe or lobes of the operated side are adherent and immobile, they may still functionate, although to a limited degree, because of the lack of negative suction normally applied to their surfaces at inspiration. If non-adherent they must remain collapsed in the presence of pneumothorax, and the aerating lung surface already reduced by the removal of the diseased lobe is again diminished by the destroyed function of the lobes remaining. If the mediastinal partition is held rigid by its own inflammatory thickening or by pericardial adhesions, the function of the lung of the unoperated side should not be hampered even in the presence of pneumothorax. On the other hand, if the mediastinum is movable it will oscillate with respiration because of the normal negative pressure on one side of it and atmospheric or slightly negative pressure on the other side. This mediastinal oscillation has been explained by Garré and Quincke to restrict both the inspiratory and expiratory function of the lung of the unoperated side.

The chief obstacles to the operative removal of portions of the lung in chronic diseases have been enumerated. In venturing suggestions as to means of overcoming these obstacles, I base my conclusions on the successes and failures of more than 100 thoracic operations of my own, and upon a study of the apparent causes for failure and success in cases reported by others; and lastly upon a long series of experimental investigations.

It is obvious that the duration of the disease and the resistance of the patient to it are of primary importance in considering the advisability of operation. As in progressive surgery of the other regions, the uncertain prognosis by operation is an ever-present obstacle to the prompt transfer of the

patient by the internist. When presented for operation, therefore, these patients are generally much reduced.

The reduction of surgical shock is unquestionably of primary importance. This will consist essentially in avoiding a one-stage operation. The necessary resection and retraction of ribs, the separation of adhesions and coincident trauma to the pleura, traction on the lung and direct nerve injury in manipulation are three factors in the excision of lung tissue which are perhaps too great to be borne at one operation even by the most resistant subject. Dividing the procedure into stages applicable to all cases is obviously impracticable and must be determined in accordance with the conditions present.

In bronchiectatic cases with abundant sputum, provision should be made not only to prevent the post-operative retention of septic secretion, but also to prevent its aspiration to the sound lung at the time of operation. W. H. Smith has suggested the advisability of prescribing an emetic an hour before operation which invariably empties the terminal as well as the main bronchi. A semi-sitting posture during operation is essential. During the exploration of the infected lobe a temporary elastic ligature may be placed at its hilus until external drainage has been procured by pneumotomy.

Rib resection alone without subsequent opening of the pleura is a faulty division of stages in the suppurative bronchiectatic cases because of the dangers mentioned above of post-operative retention of sputum. In three cases of bronchiectasis I have resected the ribs over the lower lobe, intending this as a preliminary to subsequent resection provided the collapse therapy in itself (Friedrich) should not result in a relief of symptoms. Two of these cases resulted fatally without subsequent opening of the pleura, solely because of the stagnant retention of infection secretions.

In sputum cases, therefore, the first stage must at least include the opening of the pleura, and the patient should not be allowed to come out of ether until either pneumotomy for external drainage has been performed, or a temporary mass ligature has been applied to the lobe. If in the presence of

pneumothorax the lobe collapse is extreme, the subsequent accumulation of secretion may not appear as threatening.

The second stage in such inflammatory cases should consist in freeing adhesions to render the vessels and bronchus at the hilus accessible. If such adhesions are resistant and their separation results in lacerations of the lung surface with hemorrhage, it is preferable to pack away the infected lobe and to allow an interval of a week before the final excision. If on the contrary the infected lobe can be freed readily, amputation may be at the same operation, thus avoiding a third stage. If amputation is deferred to a third operation, the technic should depend upon the conditions present. Space does not admit of a discussion of technic, but generally speaking I am convinced that the preservation of a certain amount of lung tissue at the root of the lobe is a valuable factor in producing hæmostasis and air-tight closure of the large bronchi. There is no evidence that disease will recur in this small stump of pulmonary tissue. It ceases to functionate and becomes a cicatrized mass.

Garre's successful case embodies the first two stages mentioned, namely, rib resection, delivery of the lobe with constriction of the bronchus sufficiently to retain secretions within the lobe. Being extrathoracic, the lobe can then be amputated when its condition indicates it. Sauerbruch and I performed a number of experiments to determine the success of this method in animals. Our mortality was 100 per cent.; but it may be argued that the animals died from the post-operative pneumothorax resulting from leakage around the root of the delivered lobe. The adhesions invariably present in man doubtless prevent the collapse of the lobes remaining within the chest—in other words, the susceptibility of the patient to post-operative pneumothorax is greatly reduced.

Unquestionably the successful results of Heidenhain's case and my own are due to the several stages in which they were performed. In Heidenhain's case the secretions had been largely provided with external drainage by previous thoracotomies. In my patient the exploratory operation by W. M.

C. resulted in a partial collapse of the lower lobe with accompanying empyema, the quantity of sputum meanwhile being materially reduced by the collapse therapy.

When pneumectomy is performed for conditions in which sputum is not an obstacle, rib resection, thoracotomy, and freeing of adhesions may be withstood in one stage; but there is reason to believe that success in such cases will depend essentially in postponing at least the amputation to a later operation. During the first stage when the lobe to be amputated has been separated from the adjacent lobe, if the latter is not also adherent to the parietes it should be sutured to the edge of the wound to diminish the effects of the open post-operative pneumothorax.

Although the division of lung excision into suitable stages should in itself greatly diminish the immediate and latent effects on the nervous system, anoci-association as described by Crile can doubtless be employed further to protect the brain from harmful associations. The use of gas and oxygen introduced through a mask or intratracheal tube is being employed in thoracic operations to replace ether. Novocaine can be injected into the external wound tissues and applied by compression to the rib periosteum. Trauma to the pleura can doubtless be minimized if due thought is given to this important source of brain cell destruction. The injection of quinine and urea to the wound portion of the parietal pleura may diminish post-operative sensitiveness so that the operated chest may share in respiration without causing pain.

We have admitted that post-operative pneumothorax is doubtless an obstacle to success in lung resections. We may believe that the dangers of pneumothorax at the time of operation are satisfactorily obviated by the use of apparatus. It must be emphasized, however, that although differential pressure or intratracheal insufflation be applied to the patient, the susceptibility of individuals to operative pneumothorax varies, and that the amount of assistance which they need from apparatus to prevent the onset of unwelcome symptoms varies within wide limits. Ill applied or excessive use of

these methods then must be avoided, to prevent an excess of pulmonary pressure and overwork to the right heart.

The effects of post-operative pneumothorax may be partly overcome by closing the external wound as tightly as possible around the drainage; or even by closing the wound tight for the first 24 hours, though subsequent reopening is inevitable. Adhesive plaster support to the operated chest is of value. If in spite of these provisions against the immediate effects of post-operative pneumothorax, respiratory and circulatory symptoms arise, positive pressure should again be applied with a mask, anæsthesia not being necessary for this particular method. In this way the interim previous to the formation of new adhesions may be rendered less alarming.

The following case is reported as further evidence that lung excision is at least possible by the several stage method. It is evident that excision as an ultimate procedure was not planned by W. M. C. at the primary operation, nor perhaps by C. A. P. at the second operation; but the fact remains that these two preliminary stages were unquestionably responsible for the success of the final excision. Two years and four months have elapsed since the removal of the lower lobe. The patient is sputum-free and able to work. There is a slight discharge from two small persisting bronchial fistulæ. Heidenhain argues that the fistulæ persisting in his case should not and could not be closed because of the bronchial secretion which comes from them. I am not of this opinion in regard to my own case, unless it should prove that the open fistulæ are draining secretions from the upper lobe through the main left bronchus to the lower lobe.

Although the following case has not been typical of bronchiectasis, the presence of influenza bacilli in the original sputum with the extensive formation of interstitial pneumonitis in the specimen leads me to accept the diagnosis of bronchiectasis.

CASE I.—J. R. C., dredgeman, single, aged thirty-six.

Family History.—Negative as regards possibility of inherited predisposition to disease.

Past History.—Syphilis nineteen years ago, followed by two years of treatment. A lesion, probably tertiary, on left leg three years ago. Anthrax infection of back of neck eight years ago. Malaria four years ago with occasional chills since.

December 1, 1908: *Present Illness.*—Patient has been coughing for one year. Nine months ago afflicted with increasing shortness of breath. Six months ago "took cold"; was feverish, and entered hospital in Portland, Maine, for one month, in which time there were fever, chills, dyspnoea, and night-sweats.

For past four months has been at Boston City Hospital with continuing symptoms, including an increasing cough accompanied by thin mucopurulent sputum, never containing blood. Thoracentesis performed at City Hospital four months ago; 55 oz. of fluid withdrawn with accompanying relief of dyspnoea. Six weeks later negative thoracentesis performed. Temperature has oscillated from normal to 103°.

December 1, 1908: Entered medical service of Massachusetts General Hospital.

Physical Examination.—Scars on right side and back of neck. Marked deviation of nasal septum. Pupils equal and reacting normally. Throat negative. No glandular enlargement. Heart: Apex $3\frac{3}{4}$ inches to left of midsternum. Left border not made out. Right border just to the right of right sternal margin. Systolic murmur heard at the apex not transmitted. Arteries not palpably sclerotic. Lungs: The left chest presents flatness and absence of breath and voice sounds from the fifth to the seventh rib in front and below the inferior angle of the scapula posteriorly. There is dullness and diminished breathing from the second to the fifth rib in front and over a corresponding area posteriorly. The left apical region presents dullness, harsh bronchovesicular breathing, and increased voice and fremitus both anteriorly and posteriorly. Right chest presents no abnormalities. Abdomen: Liver dullness extends from sixth rib to 3 inches below the costal margin in the right nipple line. Spleen not felt. Genitalia normal. Knee-jerks normal.

Weight, 148 lbs.; temperature, 98.6°; pulse, 90; leucocytosis, 12,000. Urine: Normal except for occasional hyaline cast. Blood-pressure: 126 mm. Sputum: Green and mucopurulent. Influenza bacilli present; also a few pneumococci. Tubercle bacilli absent.

December 8, 1908: Temperature, 101° ; pulse, 100; leucocytosis, 20,000. Sputum profuse and of same character; 24-hour amount, 16 oz. The signs in the lungs remain the same except that breath sounds are more audible at the left base.

December 15, 1908: Night temperature, 103° ; morning temperature, 98.6° ; leucocytosis, 32,600. Sputum abundant, mucopurulent, and constant. Negative search for elastic fibres. Urine: Slightest possible trace of albumin. Many hyaline and granular casts. A violent attack of coughing accompanied by rise in temperature. Left chest was filled at the time with coarse and medium moist râles. *Preliminary diagnosis*: diffuse bronchiectasis.

December 27, 1908: Temperature and pulse normal. Sputum abundant, greenish, purulent. Influenza bacilli in diminished numbers. Patient out of doors daily with improvement in general condition.

January 13, 1909: Temperature, 101.6° ; pulse, 100; leucocytosis, 35,000. Sputum abundant. General condition not changed though great discomfort accompanies night rise in temperature. Examination of the left lung shows slight tympany below the clavicle, amphoric breathing and suggestion of cracked-pot sound.

January 26, 1909: Leucocytosis, 49,000. Sputum contains many intra- and extracellular influenza bacilli. No elastic fibres. Negative thoracentesis performed in the eighth interspace midway between posterior axillary line and vertebral column. Patient transferred to the surgical service with following diagnosis: chronic fibrous pleuritis; chronic bronchiectasis of left lung; abscess of lung (?).

January 28, 1909: Operation (W. M. C.): Crescentic incision made over the sixth rib. Fifth, sixth, and seventh ribs resected from costochondral junction to posterior axillary line. Parietal pleura incised exposing adherent lung. Adhesions broken up between both lobes and parietes, and also between upper and lower lobes. A transverse incision made in the lower lobe and explored digitally. Lung tissue grayish in color and of tough consistency. Hemorrhage profuse. No pus found. Specimen of lung tissue excised for pathological examination. Wound in lung packed with gauze. Two wicks placed to the general pleural cavity.

Pathological Report (by Dr. W. F. Whitney).—A piece of

tissue removed from the lung, the pleural surface dense and fibrous and the lung tissue more or less solidified. Microscopical examination showed the alveoli filled with fluid and desquamated cells. Many of the smaller bronchi were filled up, and here and there the infiltrated tissue was softened and broken down. *Chronic bronchopneumonia.*

Patient required some stimulation in first two days following operation. Semi-sitting posture necessary to prevent dyspnoea. Discharge from wicks purulent and foul on the sixth day. The right lung normal and free from râles. Two weeks after operation discharge foul and profuse.

February 25, 1909: Discharged to convalescent home. *Diagnosis:* chronic bronchopneumonia; secondary operative empyema.

May 25, 1909: Cough has been persistent since operation. Patient otherwise comfortable except when drainage of empyema has become obstructed. Right lung remains normal.

Evidence that empyema cavity required plastic operation to diminish its size and complete its drainage.

May 29, 1909: Operation (C. A. P.): Incision from below inferior angle of scapula to left sternal border. Eighth and ninth ribs excised. Underlying tissues removed, exposing empyema cavity which was cleaned and drained. Skin and muscle flap replaced around drainage tube.

Convalescence from operation during following two weeks was uninterrupted.

June 21, 1909: Discharged to convalescent home. *Diagnosis:* Chronic empyema.

July 3, 1909: Referred to Main Hospital from Out-Patient Department because of chill, nausea, and vomiting occurring during the previous night. Temperature, 103.6°; pulse, 130; respiration, 42; leucocytosis, 28,000.

Patient remained in hospital four weeks, in which time his general condition returned to normal. Gradual fall of temperature was accompanied by increased purulent discharge from wound.

July 31, 1909: Discharged relieved to local physician.

October 18, 1909: Since last note patient's condition has been unchanged except for gradual increase in strength and weight. Discharge from empyema wound continues to be profuse; cough

is persistent and annoying, especially at night, accompanied by considerable mucopurulent sputum.

Patient advised that his diagnosis was obscure, but that the disease was both intra- and extrapulmonary, and that removal of the more infected portion of the lung was necessary.

Operation, S. Robinson. Anæsthetic (anæsthol, ether, and oxygen), Dr. Allen.

Patient placed in right semi-recumbent, semi-lateral posture. A curved incision with its convexity upward to include the scars of previous operations and the drainage wound. Muscle and skin flap reflected downward; posterior ends of ribs previously excised removed sufficiently to admit the hand freely into the pleural cavity. Adhesions extensive, preventing any indications of embarrassed respiration. Both upper and lower lobes separated from the parietes with considerable difficulty and some bleeding. Adhesions in fissure between upper and lower lobes also broken up.

Although patient's condition not alarming, it seemed advisable to complete excision of the lower lobe at a second-stage operation. The entire lung was packed away from the parietal pleura except at the apex with handkerchief gauze. The lower lobe appeared to be of firmer consistency than the upper, although the latter was firmer than normal. The patient recovered from preliminary operation during the following thirteen days, in which time the original gauze packing was not disturbed.

November 1, 1909: Second operation: Anæsthetic, anæsthol, ether, and oxygen. Incision of last operation lengthened to 10 inches. More of eighth and ninth ribs removed, permitting free access to the entire lower half of the chest cavity. Removal of the gauze exposed the lower lobe free from adhesions. The lower lobe was then clamped $1\frac{1}{2}$ inches from its root. Amputation performed distal to the clamp. The clamp then slipped from the unyielding lung tissues, permitting profuse hemorrhage from several points in the stump together with leakage of air through exposed bronchi. The large vessels were clamped separately and a mass braided silk ligature applied around the root of the lower lobe. Patient's condition somewhat threatening. Large gauze packed into pleural cavity around amputation

stump. Skin and muscle flap only partially replaced with through-and-through silk sutures.

Convalescence from second operation surprisingly good.

Fourth day after operation: Patient subjectively in better condition than for many months.

Eighth day after operation: Gauze removed without hemorrhage, also silk stay suture.

Tenth day: Patient out of doors in wheel chair. Sleeping well.

Seventeenth day: Wound cavity visible and clean with no sloughing; patient walking.

December 7, 1909: Evidences of bronchial leakage in the stump disclosed by whistling noise during coughing. Coughing since operation has been slight up to this time.

December 18, 1909: Discharged relieved to Out-Patient Department with gain in weight, absence of sputum, and a dry reflex cough.

June 23, 1911: During past year and a half, patient's general condition has been distinctly better than for the past four years. The skin flaps left unsutured have retracted into the exposed cavity and become adherent in better position than if they had been sutured to bridge the cavity. New skin has extended inward from the flaps sufficiently to cover the base of the cavity with the exception of two square inches, in the midst of which are four small bronchial fistulæ. Exploring these fistulæ with a probe causes a reflex spasm of coughing, during which the diaphragm from below and the mediastinum and the heart from within bulge prominently. There is a slight mucopurulent discharge from these fistulæ, but the reflex cough is not accompanied by sputum.

Patient advised to undergo an attempt at closure of the fistulæ to relieve the cough.

July 7, 1911: Operation (S. Robinson). Ether. Parallel curved incisions made producing a skin and muscle flap from the region of the left erector spinæ muscle. Mucous membrane of four fistulæ dissected proximally for a distance of $\frac{1}{4}$ inch, curetted, and ligated with catgut. The skin and muscle flap then swung transversely to cover the fistulous areas. The skin medianwards to the fistulæ which was free for approximation with the tip of the flap was thin and devoid of subcutaneous

tissue, and the line of approximation with the flap was threateningly near two of the ligated fistulæ.

The area bared by the transplantation of the skin and muscle flap was left open to granulate. One week after operation there was evidence of bronchial leakage through the suture line in the neighborhood of the two median fistulæ.

August 12, 1911: Cough has been greatly diminished and the discharge from remaining fistulæ much less than before operation. Patient discharged to Out-Patient Department. *Successful closure of two out of four bronchial fistulæ.*

December 4, 1911: Through the courtesy of Dr. D. C. Malcolm, of the General Public Hospital, St. John, New Brunswick, the following note is added as to the patient's recent condition: "The wound has become covered with epithelium, with the exception of an area almost an inch square one inch above the lower angle of the scapula, and half an inch in front of it. There are two bronchial fistulæ; the larger, about 5 mm. in diameter, is under the anterior border of the bone in the uncovered area above described, with a smaller one to the front of it. The discharge is greatly lessened to what it was before the last operation."

The accompanying three photographs illustrate the deformity resulting from the removal of the left lower lobe.

I am indebted to several members of the Surgical Staff of the Massachusetts General Hospital for submitting the care of this patient to me, and especially to Dr. C. A. Porter for his advice and assistance.

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ported in the literature to give to this affection a degree of considerable importance. This importance is further emphasized by a comparison of the disease in the two sexes, a study which tends to bring out many distinct differences.

Of the 25 tumors of the male breast collected by Williams, 16 were carcinomata, 3 sarcomata, and 6 various forms of benign growths. In 1885, Schuchardt collected 406 cases, 348 of which were malignant; Manger, in 1902, referred to 71 cases—some of these were probably included in Schuchardt's statistics. In 1901, Warfield collected 37 cases of cancer reported since the publication of Schuchardt's paper, and in 1906 Finsterer added 11 new cases. In addition to these, about 30 other cases have been recorded, making an approximate total of 500 instances of cancer of the male breast.

Carcinoma of the breast occurs considerably later in life in men than it does in women. In the latter, the statistics of various authors vary from 45 to 49 years, and in males the average age is about 55 years (50 years, Williams; 61.5 years, Keyser). The greatest number occurred in the seventh decade of life in both Warfield's and Manger's series, although a relatively large number also appeared in the fifth and sixth decades.

The disease may occur at an early age, as is seen in the case reports of Blodgett, Williams, Moore and Coley, in which the ages were respectively twelve, twenty and twenty-two years. The oldest case on record occurred in a man aged ninety-one (Lunn).

A definite history of injury to the breast is obtained in a sufficiently large number of cases to attach some importance to traumatism as a predisposing factor in the development of cancer. It was mentioned in 8 of 37 cases (Warfield), and Schuchardt found that contusions, small wounds, fissures and mechanical factors, were present in 25 of 406 cases. In those instances in which traumatism was followed by either blood extravasation or scar formation (Schuchardt, Dietrich, Moore), there can be little doubt that the carcinoma devel-

oped at the site of lowered vitality. In one of Dietrich's cases, after the absorption of a hæmatoma, a nodule remained, and from this a malignant growth began two years later. In a second case a blow was followed by an inflammatory tumor discharging pus, and at this spot a hard nodule developed and later became carcinomatous.

The effect of constant pressure is noted in the appearance of cancer in workmen, who, in their occupations, are accustomed to exert force in the breast region. These cases are so numerous that the etiologic importance of this factor cannot be overlooked. The chronic irritation of articles of clothing is also mentioned, and it is certain that constant rubbing in this manner seems to hasten the growth of the tumor, and certainly predisposes to ulceration in those cases in which the carcinoma has already developed.

The action of the process spoken of as adolescent mastitis in the production of benign tumors will be alluded to. That the same affection may cause a predisposition to cancer seems likely, to judge from the first case reported by the author, in which the malignant growth was preceded by several attacks of inflammation.

The effect of hereditary predisposition in the development of tumors has been mentioned by several authors, a family tendency existing in benign as well as in malignant tumors of the breast. Gangitano has recently reported two cases of benign tumors in which the families of both showed a predisposition to breast disease. According to Williams, there was a history of cancer in seven of 29 cases (24 per cent.). Of the seven cases, the breast was the seat of the cancer in three, and in three cases there was history of carcinoma in more than a single relative.

Traumatism, or some form of chronic irritation, tends to produce rapid enlargement of latent carcinomata, and the same factors are often instrumental in producing ulceration. The formation of an ulcer is more likely when the malignant process has extended to the overlying skin which becomes atrophic in appearance. The frequency of ulceration is noted

by many writers, occurring in 61 of 219 cases (Schuchardt), 9 of 26 (Williams), 13 of 37 (Warfield), 18 of 71 (Manger). About 30 per cent. of the cases, therefore, undergo ulceration, a percentage which is much higher than in the breast carcinomata of women.

The slow growth of the tumor probably accounts for the fact that from the time when first noticed until the patient came under observation, a period of 29.5 months elapsed on the average (Williams), 18 to 25 months (Finsterer). In females, this period is much less, and varies from 10 to 12 months. While the growth of the tumor is protracted in most cases and covers a period of many years in slowly growing scirrhus tumors, the length of time observed has been as short as two weeks (Moore), two months (Finsterer) and three months in the first case reported by the author.

Enlargement of the axillary lymph-nodes is observed in a majority of the cases (60 to 65 per cent.). In a few instances, no axillary enlargement was noted, and in cases whose duration was not longer than six months, the nodes were usually normal. After this period of time, as in the female, the lymphatics become affected regularly.

Some authors have found that the right breast is affected more frequently than the opposite one, whereas, other statistics place the degree of frequency slightly higher in the left. The average of a large series of cases, however, shows that the difference is so little that it is not of practical importance. The disease was bilateral in four of 88 cases (Williams), but did not begin as a primary bilateral affection in any case. Hansy reports a case in which the second tumor in the opposite breast developed so soon after the appearance of the first, that it can be regarded as an example of bilateral primary malignancy.

The clinical picture of the disease does not differ in many other particulars from that of the female. The growth, usually situated near and below the nipple, is small, hard and freely movable in the early stages. Slow growth has been mentioned, and depending upon that, we find that adhesions

to the surrounding parts with fixation of the tumor are late manifestations. The growth, in spite of its long duration, remains small, usually being the size of a small nut, and occasionally becomes as large as an apple. Pain is rarely a prominent symptom unless extensive infiltration or ulceration has taken place. In many cases, the tumor, although of a fairly large size, produced no symptoms. The nipple becomes retracted in about half of the cases because the cancer is situated close to the ducts. In a few instances, the tumor has extended to and destroyed the nipple (Warfield). Discharge from the nipple is rather uncommon, but may be bloody, milky or puriform in character.

The majority of the above symptoms, therefore, represent late manifestations of the cancer, the disease having infiltrated the surrounding parts. At this stage, the diagnosis is not difficult, but it may be so in the early stages when the tumor is small and freely movable. That the primary tumor may be overlooked and serious consequences arise from its presence, is learned from McConnell's case. The man, aged fifty-four, developed symptoms which suggested a pulmonary lesion, and a diagnosis of sarcoma of the lung was made. The breast was enlarged, but the examination did not disclose any definite tumor, so that a neoplastic process was not suspected. The autopsy disclosed metastases in many of the viscera, including the pleura and lungs, the primary tumor originating in the breast.

The malignant degeneration of benign tumors will be alluded to. Sudden growth of a pre-existing tumor, with fixation of the mass, and especially if present in middle-aged men, should always warrant the diagnosis of malignancy and call for its appropriate treatment.

The histologic examination of the cases shows that the carcinoma arises most commonly from the ducts of the gland and less frequently from the acini, as is to be expected from their lack of development.

Williams's hundred cases were divided as follows: acinous 91 (scirrhous 88, encephaloid 3), tubular 6 (cylinder cell duct

cancer), cutaneous squamous cell cancer, 3. While the scirrhus variety is most commonly observed, the relative proportion is not so high in Warfield's series, 11 of 26 cases being scirrhus cancers.

A peculiarity of the histologic examination is noted in the number of melanotic and squamous carcinomas contained in Williams's collections. Of the scirrhus growths, two were melanomas; and one of the three squamous carcinomata was a melanotic tumor. This frequency is explained by the fact that skin growths, in general, are much more liable to affect the male sex. The melanotic tumors also arise much more frequently in connection with structures of integumentary origin. The male breast being of this type and having lost most of its special characters, is in a process of reversion to the primordial cutaneous condition, and herein may be an explanation of its comparative proneness to melanosis.

The recurrent disease is found usually in or near the scar of the operation, or it may arise in the axilla or opposite breast. It is worthy of note that the carcinoma was present, on an average, 20.4 months before operation was undertaken in five recurrent cases reported by Finsterer. The duration of life from onset of the tumor in these cases averaged 51.4 months, in spite of the secondary growths. On the other hand, in exceptional cases, the disease assumes a rapid growth, and its highly malignant character is manifested by recurrence a few months after operation. Manger states that 70 per cent. of the cases died of recurrence or metastasis, and that recurrence arose in 19 of 72 patients in a few months to 5 years. There were 9 recurrences within 6 months of the operation, 3 within 1 year, 2 within 2 years, 3 within 4 years, 1 within 5 years, 1 within 6 years. The tendency toward late recurrence 5, 10 or more years after operation, which is rather common in women, does not exist in men, the majority of the cases reported recurring within a comparatively short time, and a few living 5, 6 or 8 years before local recurrence arose.

Secondary growths involving the internal organs are most

commonly found in the liver and lungs. In 5 of 88 cases (Williams) deposits were noted in the bones; both clavicles and tibiæ, the vertebræ, the sphenoid and base of the skull were involved in one case each.

The operative mortality in Williams's statistics was 36 per cent., two deaths occurring in 56 amputations of the breast. Death in these cases was due to sepsis; this complication is practically unknown at the present day. The operative mortality at present is *nil*, the 34 cases collected by Warfield in recent times, and 30 I have reviewed, all recovered.

It is impossible to judge accurately concerning the percentage of cures because this fact is mentioned in a comparatively small number of cases. Finsterer was able to find but six cases in the literature in which it was stated definitely that recurrence had not arisen. Two of the cases in his series lived 21 and 11 years; Blodgett's case 5 years, and the second case reported by the author has lived 3 years without further trouble.

The following cases of carcinoma of the male breast are reported for the first time:

CASE I (Service of Dr. E. B. Hodge, Presbyterian Hospital).—Patient aged fifty-five, noted three months ago a small nodule below the breast. He states that when a boy the breast became red, painful, and swollen, and several times during adult life, similar attacks of inflammation occurred. At these times there was a slight discharge of clear fluid from the nipple. There was no history of trauma to account for the attacks. On examination, a hard nodule, the size of a hickory-nut, was found below the nipple, which was slightly retracted. The mass was adherent to the underlying tissues and was painless. The skin was atrophic in appearance and at a point over the tumor was brawny and infiltrated. One enlarged lymph-node was palpable. The tumor, when removed, was dense and stony hard, and showed microscopically a typical scirrhous carcinoma. The single enlarged lymph-node was not involved. There has been no recurrence nine months after operation.

CASE II (Service of Dr. C. H. Frazier, University Hospital).

—R. C., male, aged forty-eight, was admitted with the history of a recurrent tumor of the left breast. The growth appeared two years ago without cause and without pain, and seven months after it was first noted, the lump and nipple were excised. He remained well until a few months ago when a second nodule appeared and was excised. The histologic examination showed carcinoma in both instances, and the patient was finally persuaded to accept radical operation. The axilla contained several enlarged nodes which were removed, and, beneath the scar of the first operation, several nodules were found. These and the axillary lymph-nodes showed infiltration of a scirrhus type. No recurrence at the present time, three years after last operation.

SARCOMA.

Sarcoma of the female breast occurs in 1 to 2 per cent. of the cases, and as an affection of the male gland must be regarded as a very rare condition. In Schuchardt's statistics, only six cases are mentioned in which the diagnosis was confirmed by microscopic examination, and the three instances occurring in Williams's collection of 2422 tumors of the breast have been alluded to. In 1906, Finsterer found 12 sarcomas of the male breast in the literature, three of these he reported for the first time. Connell a year later reported a case occurring in a male aged twenty-five and thoroughly reviewed the subject, collecting, in all, 34 cases.

The clinical features of this form of malignancy resemble carcinoma in some particulars, and, in others, differ sufficiently to justify a diagnosis between the two. Finsterer has found the average age to be considerably lower than that of carcinoma—sarcoma 45.6 years, carcinoma 55 years. The following table represents the age incidence (Connell):

20 to 25 years	4 cases
30 to 35 years	3 cases
35 to 40 years	2 cases
40 to 45 years	3 cases
45 to 50 years	1 case
50 to 55 years	5 cases
55 to 60 years	1 case
73 years	1 case

The tumor begins as a small, freely movable nodule, which grows rapidly as a rule, reaching the maximum size within a year. Sarcomata in some cases may become as large as an orange or a child's head. The skin is involved in a comparatively small number of cases, therefore the formation of ulceration is seen much less frequently than in carcinoma. Fixation of the tumor to the underlying tissues is a rather late manifestation. Involvement of the axillary lymph-nodes, on the other hand, occurs frequently. In 20 cases Connell found axillary involvement mentioned 9 times; skin involvement 4 times; fixation to fascia 3, and no adherence 7.

While the tumors grow rapidly in the majority of cases, occasionally a period of several years elapses before they reach any considerable size, the average duration of the disease being much less than carcinoma. Family predisposition and traumatism play a less important rôle than they do in cancer, for Connell has found but two instances of the former and one of the latter.

Histologic examination has disclosed all varieties of sarcoma; the spindle-cell type, which predominates, is the least malignant. The varieties are subdivided as follows: spindle-cell 12, round cell 7, chloroma 1, cystic 3, and melanotic 3.

Some of the cases which have been reported should not be classified as breast tumors because they have originated in the skin, as pigmented moles or nævi. Sarcoma is reported to have developed from a nodule in the breast of 22 years' duration, and from other benign tumors most likely adeno-fibromata in nature.

The final result of the operative measures has been mentioned in comparatively few cases. Finsterer could record but one case of cure; in this there was no recurrence after 11 years. Connell mentions 11 recoveries. One case free for 2 years after the fourth operation; one recovery with development of keloid; recovery with development of erysipelas on second day, no recurrence after 11 years; one recovery with inoperable recurrence, after one year Coley's treatment. Deaths three; death after second operation within five months. one case.

BENIGN TUMORS.

Of the 25 tumors in the male breast, recorded by Williams, 16 were cancerous, 3 were sarcomatous and 6 were benign. Schuchardt's first collection included 274 malignant growths and 21 benign ones. Numerous reports of benign growths of the male breast point to the fact that the pathology of these conditions does not differ essentially from that of the female, and that the various tumor formations so common in the latter may find their counterpart in the male gland.

The least common benign tumors occurring in either the male or female breast are those composed of a single type of tissue. These cases are so rare that they are of most interest from a pathologic stand-point. The cases which have been reported by various authors include fibroma, myxoma, chondroma, angioma, adenoma, and myoma. Several instances of true lipomata presenting noteworthy features are on record. The tumors, for the most part, occur in middle-aged men, are soft, and occasionally reach a size to cause real discomfort. They are painless, of slow growth, and require several years to attain any considerable proportion. The lipoma observed by Queirel became as large as a child's head in 15 months, while in Masse's case the growth was congenital, and grew more rapidly, becoming the size of an orange in nine months. While the tumor in the last case occupied the mammary region, there is some doubt as to whether it and several other lipomata of congenital origin originated in the breast.

The most common tumor described is the fibro-adenoma, which Woodyatt divides into two groups:

(1) Sharply circumscribed form, dense tumors which arise without traumatism in the breasts of young men and run a painful clinical course. Microscopically, there is little or no evidence of inflammation, but all the characteristics of the fibro-epithelial tumors which occur in the breasts of young females, to which they are analogous.

(2) Diffuse or ill-defined growths which may occur at any age as the result of traumatism. Microscopically, these

enlargements have the same structure as those of the first group. Signs of inflammation are more in evidence, however, so that their differentiation from chronic inflammation may not be easy. They are called fibro-adenoma because of their progressive growth and microscopic structure. This formation corresponds to the "traumatic indurations" of some writers.

Fibro-adenomata of the male breast vary greatly in size. The tumors seen in boys in conjunction with inflammatory symptoms (adolescent mastitis) are usually small. Their growth is generally slow and progressive, several years elapsing until they reach the size of a walnut, an egg, or even an orange. In Whelan's case, the tumor began at the age of eighteen, and when removed, eight years later, weighed one-half pound. Rapid growth of the tumor may occur, as is seen in the instance recorded by Griffin which is of interest also because the growth was bilateral:

The patient, aged forty-five, was struck seven weeks previously over the left breast, after which a tumor slowly grew until it reached the size of a hen's egg. Four weeks later a tumor in the opposite breast was removed; this growth was noticed one week after the first operation. Both tumors were fibro-adenomata on microscopic examination.

The interval between the appearance of the second tumor in the opposite breast is not always so short, as is indicated in Gangitano's case:

A fifty-seven-year old man had a small tumor removed from the right breast sixteen years ago. During the past four years the left breast gradually increased in size, becoming denser than normal, painful on pressure but freely movable, and several enlarged axillary lymph-nodes developed. The breast was amputated, and microscopic examination showed a fibro-adenoma.

A second instance reported by the same author occurred in a male aged sixty-six, in whom bilateral tumors developed over a period of seven or eight years, and reached the size of an apple in the right and a hazelnut in the left breast. The latter was removed and found to be an adenofibroma.

Many cases give the history of antecedent injury to the breast. This effect is mentioned by Denenholtz in a case of bilateral growth in a boy of fifteen years. It is doubtful if

traumatism plays an important predisposing rôle, as the injury is much more likely to call attention to a tumor already present in the breast, a fact commonly observed in growths in the female gland.

During the past few years considerable attention has been directed to the fact that all benign tumors of the breast are potentially malignant. In the female the possibility of carcinomatous degeneration is almost in direct proportion to the amount of epithelial hyperplasia in the primary tumor. We find, therefore, that the fibrous type of the fibro-epithelial tumors becomes malignant in a relatively small per cent.; and that the tumor formations with active proliferation in the ducts and acini undergo malignant change in as high as 24 per cent. of the cases. In other words, the adenofibromata rarely degenerate, whereas the cystadenomata and the cases of abnormal involution frequently become malignant.

It is to be expected, therefore, that tumors of the male breast should undergo similar degenerative changes, although the relative proportion should be less as the factors conducive to epithelial hyperplasia are not so active in the male. Carcinomatous formation in a pre-existing fibro-adenoma has been reported by Owens and Eisendrath.

The patient, aged fifty-six, noticed a slight depression of the nipple and a nodule, the size of a pea, in the right breast. The condition remained unchanged for 36 years, when a small scab formed on the nipple which would bleed slightly when the scab was removed. The nodule began to enlarge one year ago, and formed a hard tumor one inch in diameter, sharply circumscribed from the surrounding skin. The overlying skin was atrophic, bluish in color, and immovable. The microscopic examination, after extirpation of the tumor, showed a scirrhous carcinoma, which undoubtedly arose in the benign tumor described.

What relationship exists between adolescent mastitis and adenofibroma is not clear, although Woodyatt suggests that the former is a separate affection, as a sequel to which the adenofibroma may develop, for many of the cases of sharply circumscribed adenofibroma in youth have developed in the course of what appeared to be "adolescent mastitis." The following case which I observed for a period of three months seems to bear out this theory:

The patient, aged twelve, complained of pain and burning in the right breast, which, when examined, was slightly larger than the opposite one. The skin was red, but other evidences of inflammation were absent. The pain and swelling subsided under local treatment and the boy was discharged. He returned two months later, complaining of a lump in the breast, which, he said, was noticed several weeks after treatment was discontinued. The tumor was the size of a pea, hard, freely movable, tender on pressure, and situated below and to the outer side of the nipple. The growth was excised under local anæsthesia. The microscopic examination disclosed a fibro-epithelial tumor, in which the periductal fibrous tissue predominated. The ducts and acini were relatively few in number, and were lined with several layers of cuboidal epithelium. In a few acini more active hyperplasia caused the formation of solid plugs of cells, which were, however, non-invasive in character. Diagnosis: fibro-adenoma.

The above case illustrates the type of tumor occurring in Group I, and the following instance may be taken as an example of Group II:

Male (service of Dr. John B. Deaver, German Hospital), aged sixty-eight, noted a lump three months ago in the left breast. Little attention was paid to it until two months later, when it became slightly painful and enlarged progressively. The mass was situated under the nipple, and felt as large as a goose egg, but was not tender. No enlargement of axillary lymph-nodes was noted. The growth was excised. It was made up of fairly dense white tissue, which was not encapsulated as is the ordinary fibro-adenoma. Microscopically, a fibro-epithelial process was seen. The periductal tissue showed proliferation, was fairly cellular and contained many round cells. The acini were more numerous than normal, the lining cells were cylindrical and occurred in several layers. The degree of epithelial proliferation was excessive, but the cells did not extend into the periductal tissue. Slight dilatation of the ducts was seen, and in some of the cystic cavities, small papillæ were present. Diagnosis: adeno-fibroma.

The cystadenomata of the breast are not so common as the fibro-adenomata, although a number of cases have been re-

corded in the more recent literature. The line of demarcation between the cyst- and fibro-adenomata is not sharp in all cases, indeed it is contended by some that there are transition stages of one to the other. From the pathologic standpoint, however, it is of importance to make this distinction because the cystadenomata are more likely to carcinomatous degeneration, and from the clinical point of view they differ from the fibro-adenomata when cyst formation is prominent. The tumors are usually small and well circumscribed, but may become as large as an orange when cyst formation is extensive. The case recorded by Worbs caused considerable inconvenience on account of its large size, and for this symptom alone surgical intervention may be sought. The tumors are seen usually in men of advanced years, most of the cases occurring between the forty-fifth and sixtieth years of life, whereas the fibro-adenomata are frequent in youth. In Spencer's case the tumor was present since birth, enlarged rapidly when the boy was four years of age, and reached the size of an egg within three weeks. The breast when removed contained multiple cysts, the contents of which were bloody.

The cysts give to the tumors a definite fluctuation in some cases, and the fluid may be bloody, clear, or dark brown. Milky fluid was observed in a cyst occurring in a child eighteen months of age (Carpenter). The tumor was treated by aspiration, so that its true nature was not ascertained. In many instances papillary excrescences are present in the cysts, and these cases should be classified as papillary cystadenomata.

The following case represents an example of cystadenoma, the differentiation from fibro-adenoma being impossible clinically, as cyst formation was inconspicuous.

The patient, aged twenty-seven, noticed eight years ago a very small painless lump under the left nipple. It remained stationary until last year, when rapid enlargement took place. The patient attributes the growth to traumatism caused by boxing. The tumor, at the time of operation, which was performed by Dr. H. T. Harvey, was the size of a hen's egg, firm, movable,

with skin and nipple appearing normal, and on palpation was tender. The mass, when removed, was firm in consistency, white in color and contained small cysts scattered through the tissue. The cyst walls were smooth. Microscopic examination showed a dense fibrous stroma in which a few ducts and a large number of regular acini appeared. The epithelial cells were increased in number, forming a lining composed of several layers of cuboidal cells which were greatly compressed in the dilated acini. The cyst formation was seen in both the ducts and acini, and in many of the latter, minute papillæ projected into the lumen of the dilated spaces. Diagnosis: cystadenoma.

Cystadenomata may also undergo malignant degeneration as demonstrated by Peachell's report:

The man, fifty-eight years of age, had an abnormal development of both breasts, and in the left one, a tumor which began two years ago. The growth was small, irregular, soft, non-adherent to the skin or underlying tissues, and discharged a bloody fluid from the nipple. It was diagnosed a duct papilloma. A year later the growth presented a greatly altered picture: it was hard in consistency, adherent to the skin and pectoral fascia. The bloody discharge continued from the nipple, which became retracted. The breast was removed and the tumor found to be a scirrhus. The patient died of an intercurrent disease nine months later without recurrence or metastasis of the cancer.

CONCLUSIONS.

1. Carcinoma is the most frequent tumor of the male breast.
2. The disease is seen later in life, grows slower, ulceration is more common, and traumatism plays a more important rôle than in women.
3. The operative mortality is *nil*; but the percentage of cures is probably much lower than in the female.
4. Benign tumors are subject to the same malignant degenerations, as are similar tumors in the female.
5. Adenofibroma is the most frequent type of benign tumor encountered, although all varieties have been met with.
6. Adenofibroma in young men may be produced by the affection termed "adolescent mastitis."

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THE CLINICAL FEATURES AND TREATMENT OF ACUTE PERFORATING GASTRIC AND DUODENAL ULCER.

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ALTHOUGH the medical and pathological aspects of an ulcer occurring in the stomach or duodenum had long been recognized, it was commonly regarded as a fatal complication until scarcely thirty years ago, when Mikulicz made the first attempt to cure such a condition by surgical intervention. Although he was unsuccessful, yet the soundness of the principles which he had carried out was quickly recognized, and by following his example other surgeons have achieved considerable success and have brought the operation for the relief of perforation to a very high degree of perfection.

Notwithstanding this progress, perforations still frequently escape recognition or are mistaken for other lesions, and the resulting delay in the application of the proper treatment leads to the needless sacrifice of many lives. It is for this reason that the importance of the early recognition of a perforation by the internist has been frequently emphasized. He ordinarily is the first to see the patient, and it is by him that either the correct diagnosis must be made or the gravity of the symptoms recognized as indicating a condition which can be satisfactorily dealt with by the surgeon only.

In a paper read by invitation before the New Jersey State Medical Society in 1908 and subsequently published in the

journal of that association as well as in the *American Journal of Surgery* in October, November, December, 1908, and January, 1909,³⁰ the writer discussed with considerable detail the typical clinical features and treatment of this condition. It will, therefore, be unnecessary to indulge in needless repetition, although the importance of the subject warrants the mention of the more prominent symptoms in order that they may serve as a standard of comparison in speaking of the less frequent but equally important atypical variations of which they are capable.

Briefly, the perforation is usually preceded by a more or less well-defined history of gastric disturbance, which in many instances does not differ materially from that of a chronic dyspepsia; exceptionally the perforation may occur without the slightest premonition at any time of day or night in a patient who, up to that time, has enjoyed perfect health.

The onset of the perforation is marked by severe pain. This is undoubtedly the most constant subjective symptom. It is almost always knife-like in character, epigastric in its location, and is frequently borne by the patient only with the greatest difficulty. If it comes without warning the patient's task or occupation is suddenly interrupted, and if he is aroused from sleep any movement becomes difficult or impossible. The pain is usually increased by inspiration, by turning from one side to the other, by raising the body, unassisted by the elbows, to a sitting posture, and possibly by the flexion of one or both thighs. These different ways of eliciting or intensifying the pain, variable according to the location of the exudate and the direction of the spread of the peritonitis, are material aids in reaching an accurate diagnosis.

Vomiting, although by no means constant, is next to pain the most important subjective symptom. In Petré's¹⁰² series of 92 cases it was present in 43 cases of gastric and 10 cases of duodenal perforation. It was absent in 22 cases of gastric and 5 cases of duodenal perforation. The initial vomiting due to peritoneal irritation occurs probably in from one-

half to two-thirds of all cases of acute perforation shortly after the advent of the pain, and may recur with increasing frequency as the peritonitis becomes further advanced.

The character and the quantity of the vomitus depend upon the character and the quantity of the stomach contents at the time of perforation. It is a well-known fact that perforation may occur in stomachs quite empty, in which event the vomitus consists chiefly of bile and mucus; on the other hand, in stomachs more or less distended with food, the vomitus may be abundant, and consists of partially digested food. Blood in any considerable quantity is at all times a rare constituent.

Vomiting is more commonly observed in cases of duodenal than in those of gastric perforation, for in this latter condition the physiological act of vomiting is, of necessity, materially modified by the fact that even with but slight expulsive effort the gastric contents escape more easily downward through the perforation into the peritoneal cavity than upward through the œsophagus, whereas in perforation of the duodenum the stomach wall is intact and the mechanism of vomiting, in consequence, is undisturbed. In gastric perforation proper, the frequency of vomiting is thought by some to depend upon the facility with which the gastric contents can escape into the peritoneal cavity. Thus, Leroy and Minet and Durrgey,⁷² with several other authors, state that in perforation near the cardia and lesser curvature vomiting is less frequent than where the perforation is nearer the pylorus or greater curvature. Based upon this theory is the treatment suggested by Patterson,⁹⁷ that in those cases in which through inaccessibility a perforation, usually near the cardia, defies either detection or satisfactory closure, an immediate posterior gastro-enterostomy provides for the rapid escape of the gastric contents into the jejunum, and thereby prevents, through over-flow, their passage into the general peritoneal cavity.

Before leaving the question of vomiting, the writer wishes

to call attention to the fact that in two cases herewith reported, this symptom was entirely absent. In Case XI the patient had had occasional attacks of vomiting prior to the perforation, while during the thirty-six hours between the perforation and operation, no vomiting whatever occurred. In Case X there was neither vomiting nor even the suggestion of nausea.

Shock, with its associated symptoms, is certainly the exception in both gastric and duodenal perforations. In many cases the pulse is scarcely increased in frequency during the first two or three hours after perforation, and in Case X reported by the writer the pulse was strong, of excellent tension, and but 48 in frequency seven hours after the perforation. If shock is present, it is at least so transitory in most instances that by the time of the first medical examination it has practically disappeared. It is essential to emphasize this fact, for the opposite view, frequently held by different authors, leads to erroneous diagnosis and to dangerous if not fatal delay in operation. For similar reasons it is well, in this connection, to emphasize the fact that shock, when present, is no contraindication to immediate operation. This statement is again at variance with the more or less widespread belief that under such circumstances operation should be deferred until the shock has subsided. Every hour of delay in diagnosis or of delay in operation after the diagnosis has been made decreases the chances of the patient's recovery.

The objective symptoms are most important. The character of the respiratory movement of different segments of the abdominal wall, the preponderance of thoracic over abdominal breathing, the presence of tenderness and especially of muscular resistance, together with the dulness in either the left or right flank, due to the exudate, have all been fully described in the paper already referred to. The writer is still of the opinion that muscular resistance is the most constant and most valuable objective symptom, and in its point of maximum intensity the most reliable guide to the site of the

lesion. Attention is again directed to the value of an increase in the resistance of the costal arch as an aid to diagnosis. In their escape the gastric or duodenal contents must of necessity pass downward through either the right or left lumbar gutter. The former in duodenal perforation is facilitated by the absence of the transverse colon which, in gastric perforation, inhibits for a time the passage of fluid into the left flank. In either event the resulting peritoneal irritation is reflected by an increase in the resistance of the lower segment of the corresponding costal arch which, in expiration, is less easily and less extensively displaced toward the vertebral column than on the non-affected side.

The disappearance of liver dulness is, still, in the writer's opinion, an exceptional and therefore unreliable symptom. In duodenal as well as in many cases of pyloric perforation, little if any gas passes into the peritoneal cavity. The same is true of gastric perforations at a distance from the pylorus in which perforation occurs when the stomach is empty. It is chiefly in perforations occurring shortly after eating, at a time of gastric fermentation, and in a zone of the stomach more or less remote from the pylorus that gas may be expected to escape in sufficient quantity to modify the normal liver dulness. Petré¹⁰² observed gas on opening the peritoneal cavity in about one-third of his cases of gastric perforation and in only two of 18 duodenal perforations. In a note he states that observations in regard to the disappearance of liver dulness were not made with sufficient frequency to be of any value. In a number of these cases, however, the gas was in such small quantities that it could have had no appreciable effect on the normal area of liver dulness.

Dulness in either flank is unquestionably a symptom of great value. Small amounts of fluid in this location can, in the writer's experience, be readily detected with the aid of auscultation. In the hands of others, auscultation does not always seem to render the same assistance in eliciting this symptom. It is well in this connection to call attention to the

symptom described by Shoemaker,¹⁰⁵ in which a dull percussion note over fluid in the flank gradually assumes a tympanitic quality when by an increase in pressure of the percussed finger against the abdominal wall, the fluid is displaced and the intestine brought into closer proximity.

The frequency with which cases of acute perforation fail to be recognized and the consequent unnecessary prolongation of an operation in which the utmost speed is essential by the making of one or more exploratory incisions at a point distant from the lesion certainly justify a brief consideration at least of their differential diagnosis.

Although conditions with which acute perforation might be confused should theoretically be limited to lesions in the right upper quadrant or at least to lesions in the epigastric region, yet as a matter of fact it is more frequently confused with an acute appendicitis than with any other condition. Both are frequently preceded by a history of gastric symptoms of variable intensity and degree; in both the onset of the attack is usually marked by severe pain with or without vomiting, the elevation of both pulse and temperature, and a definite leucocytosis. They are generally to be distinguished by the fact that in gastroduodenal perforation the onset of the pain is sudden, while its location is more definitely epigastric. In appendix the pain, at first referred to the region of the navel, is ordinarily reflected within a few hours to the right lower quadrant. This rule, however, has many exceptions. In the early hours after the onset of either lesion the diagnosis should be easily made by the difference in the physical signs; while in perforation the tenderness and rigidity are most marked above the level of the navel to the right (duodenal or pyloric) or to the left of the median line (cardia), according to its location, in acute appendicitis the tenderness and rigidity are most marked in the right lower quadrant. In perforation the dulness is elicited in either the right or left loin, while in appendicitis it is more tardy in its appearance and is located at first between the anterior superior spine and the umbilicus.

After the first 12 to 24 hours the physical signs more closely resemble each other if the perforation is in the vicinity or below the level of the pylorus, for by this time, or even earlier, the contents of the stomach or duodenum have passed through the perforation down through the right lumbar gutter into the pelvis, and the resulting rigidity and tenderness referred to the lower part of the abdomen may be more intense than the rigidity at first elicited over the site of the perforation. With advancing and general peritonitis, the differential diagnosis becomes increasingly difficult and sometimes impossible without the aid of an exploratory incision.

In case of error the correct diagnosis is readily made as soon as the abdominal cavity is opened, by noting the actual gross pathological condition. If the appendix is exposed by the McBurney incision, the prolongation of the operation is almost *nil*, for, by this route, the peritoneal cavity can be opened in less than a minute and the opening subsequently used for pelvic drainage. The difference in the gross pathology of perforation and acute appendicitis was fully described by the writer in his previous paper,³⁰ and the importance of the subject seems to warrant its repetition at this time.

The fact that acute gastric and especially acute duodenal perforation is frequently mistaken for acute appendicitis warrants a brief statement of the chief gross pathological differences of these two conditions when, under the impression that an acute inflammation of the appendix exists, the right lower quadrant of the abdomen is opened. In both, fluid usually escapes when the peritoneum is divided. In gastric or duodenal perforation, this fluid is yellow, usually free from odor, and is distributed uniformly and without change of color, odor, or consistency around the cæcum and between the intestinal loops that lie in the pelvis. It is usually more abundant as the upper part of the ascending colon is exposed. The change in the appendix is limited to its peritoneal coat which, like the serous investment of the adjacent intestine, may be

reddened and injected. In a severe acute appendicitis, on the other hand, the fluid near the parietal peritoneum is usually serous. It is relatively small in quantity and free from odor. As the appendix is approached, however, the fluid rapidly becomes turbid, and finally the appendix, discolored and friable, is usually found surrounded by thick offensive pus which may be in whole or in part shut off by adhesions from the general peritoneal cavity. In the absence of such characteristic changes both in and around the appendix, the source of an incipient general peritonitis of dubious origin most probably lies in a perforation of the stomach or duodenum, and the exposure and thorough search of these two structures should follow immediately.

The lesions in the upper right quadrant for which acute perforation may be mistaken include those of the gall-bladder, the pancreas, and the appendix. The rare cases of appendix in this region include those in which the cæcum is undescended, the appendix, in consequence, being out of its normal position, and those equally rare cases in which the tip of an unusually long retrocæcal or paracæcal appendix lies in proximity to the liver or gall-bladder and in this situation becomes gangrenous.

Severe acute cholecystitis, especially of the gangrenous type, with or without perforation, may simulate acute perforation at or near the pylorus so closely as to render differential diagnosis well nigh impossible. Both subjective and objective symptoms differ in degree. Both have in common a sudden onset, severe pain intensified by respiration, vomiting, constitutional disturbance, and prostration. In perforation the pain is usually nearer the mid-line than in acute cholecystitis, although exceptions to this rule are numerous. In both there are tenderness and rigidity over the upper part of the right rectus and the right costal arch. In cholecystitis, if the gall-bladder lies beneath the costal border, tenderness may be elicited by pressure on the junction of the eighth and ninth costal cartilages; in perforation, tenderness is referred by the

patient to a position nearer the mid-line in the epigastrium. In perforation, the rigidity is more intense and involves a wider area than is generally the case in cholecystitis. In several instances of perforation, herewith reported, the dulness extended from the loin to the outer margin of the rectus muscle; in cholecystitis the fluid is much smaller in amount and the dulness is obtained over a correspondingly smaller area.

On opening the abdomen, the correct diagnosis is obvious. Fortunately a right pararectal incision, enlarged if necessary by a second incision extending from its upper extremity inward to the median line, exposes the gall-bladder, the duodenum, and the pyloric end of the stomach, and serves equally well for the detection of an enlarged, swollen, tense, and discolored gall-bladder on the one hand or for a pyloric duodenal perforation on the other. Through this same incision the appropriate treatment of either condition can easily be carried out.

The differential diagnosis between perforating ulcer and acute pancreatitis may be much more difficult than between perforation and either appendicitis or cholecystitis. In the latter conditions, difficulty is experienced only when the perforation is either at the pylorus or its immediate vicinity, for in that event the symptoms are most pronounced on the right side. If, on the other hand, the perforation is in the middle of the stomach or between this point and its cardiac extremity, the symptoms are referred either to the mid-line or to the left of the mid-line, and the resulting exudate together with the contents of the stomach give dulness in the left loin. Both subjectively and objectively, therefore, the symptoms of acute perforation near the cardia can simulate those of an acute appendicitis or cholecystitis only when the appendix or the gall-bladder lie to the left of the median line—an improbable though not impossible location. On the other hand the pancreas, like the stomach, extends to either side of the median line. It is obvious, therefore, that an acute pancreatitis, in-

volving the head of that organ, will result in objective and subjective symptoms which are referred to the right upper quadrant, while in similar involvement of its tail the symptoms are referred to the left upper quadrant and to the left loin. In the former event the symptoms may be almost identical with those of a duodenal perforation and in the latter case to those of a perforation near the cardia. The two conditions are to be distinguished mainly by the detection of some disturbance of the pancreatic digestive function. At the time of operation, however, a correct diagnosis is usually not difficult. Again, as in cholecystitis, a pararectal incision gives convenient access to the head of the pancreas. On opening the peritoneal cavity abundant free fluid is found, which in pancreatitis is dark-colored if not actually blood-stained, while in duodenal perforation the fluid is acid in reaction, not infrequently mixed with gas, and contains a certain amount of stomach contents. The occurrence of small patches of fat necrosis in the overlying omentum is extremely suggestive of pancreatitis. Inspection and palpation of the stomach shows that organ normal and probably in a distended condition, while on deeper palpation the head of the pancreas is felt to be swollen, elastic, and enlarged.

Errors in the diagnosis of acute perforation of the stomach are not confined to lesions of the appendix, gall-bladder, or pancreas, but include other conditions as well. The occasional obstipation, together with vomiting, may suggest intestinal obstruction. In Case XI herewith reported, even in the total absence of vomiting for 36 hours subsequent to the perforation, this diagnosis was made by two surgeons in view of the marked obstipation and also in view of the fact that, owing to the spread of the peritonitis, the physical signs in the left lower quadrant were as marked as those in the upper right part of the abdomen. Mention is also made in the published reports of cases by different observers of operation for supposed ectopic gestation and even for renal calculus.

The consideration of the differential diagnosis of perforating ulcer could not be passed over without emphasizing one final important point that, no matter what the condition which may simulate a perforation, immediate operation is just as necessary and delay may be just as dangerous as if a perforation actually existed. In other words, that any lesion of which the subjective and objective symptoms simulate perforation should be immediately referred to the surgeon, and that delay for any reason can only be prejudicial to the patient's interest and is therefore entirely unjustifiable.

A knowledge of the essential gross pathological features of perforating gastric and duodenal ulcer facilitates their rapid discovery when the abdominal cavity is opened. The perforation is most frequently located on the anterior wall at or near the pylorus. From this point perforations are found with diminishing frequency along the lesser curvature toward the cardiac end of the stomach. They are much less commonly found at or near the greater curvature or on the posterior wall of the stomach. (The writer has never found a perforation in this last mentioned situation.)

Ulcers in which perforation may occur are single or multiple; in the latter event ulcers may be found simultaneously in the stomach and duodenum. The coexistence of ulcers is not uncommon. F. Brunner¹⁶ estimates that in from one-quarter to one-third of all cases multiple ulcers are present. On the other hand, multiple perforations are rare. The writer, in his previous paper,³⁰ collected 18 cases of this character, and to this number must now be added four others reported by Petré¹⁰² in his series of 92 cases and four more reported by Villard and Danatello¹¹⁴ in a series of 115 cases. In the same paper the writer also called attention to the fact that in many instances perforations occurred simultaneously at corresponding points on the anterior and posterior walls of the stomach; in other cases the perforations were situated either close together or were separated by a considerable interval on the same side of the stomach. In almost every

instance of multiple perforation, the second perforation was not found at the time of operation and was discovered only at the subsequent autopsy. The ease with which multiple perforations are overlooked emphasizes the necessity of a rapid but careful search of both sides of the stomach before the abdominal wall is closed; while the anterior wall may be quickly inspected, the posterior wall can be adequately searched only after opening the lesser peritoneal cavity either through the gastrohepatic omentum, the gastrocolic ligament or the transverse mesocolon. If perforation exist, the lesser cavity will contain gas, stomach contents, or exudate in varying amounts.

A secondary perforation in a coexisting ulcer may take place several days, weeks, or even months after the primary perforation has occurred. It is to prevent this accident that a gastro-enterostomy has been advocated, but even the addition of this measure has not always accomplished this purpose.

The writer wishes also to call attention to the fact that the orifice of a small perforation may become temporarily closed through a plug of fibrin and the escape of the gastric contents delayed until the plug is dislodged. In one of Schoemaker's ¹⁰⁵ successful cases, operated on six days after the perforation had taken place, the perforation was closed in this way and the peritonitis was still circumscribed. Another fact of interest is that in perforations of the posterior wall of the stomach the peritonitis may be confined through the fortunate prior obliteration of the foramen of Winslow (not an uncommon condition in gastroduodenal ulcer) to the lesser cavity. In another of Schoemaker's ¹⁰⁵ recoveries this condition was found in a patient operated on three days after the perforation had occurred.

The treatment of perforation is exclusively surgical, and consists in the closure of the perforation with or without a partial or complete excision of the ulcer proper. Complete excision is of value in small perforating ulcers in any acces-

sible portion of the stomach or duodenum, when the resulting gap can be easily closed without undue tension. Excision is of special value if closure of the perforation by suture is impossible because of the friability of the tissue through which the sutures must pass. On the other hand the closure of gaps after excision of large ulcers may be difficult, and the lumen of the viscus, especially in the pyloric and duodenal zones, unduly narrowed. In cases of this character, as a substitute for excision the perforation can be closed satisfactorily by the superposition of an adjacent viscus, preferably of the gall-bladder as has been done by Bessel-Hagen^{9a} and Downes,²⁰ or by the apposition and suture of an omental flap over the weakened area, as has been done by Braun¹³ and Gibbon. The plugging of the orifice of the perforation with omentum has been followed in several instances by its necrosis and secondary perforation. As a last resort, perforations, which cannot be effectively sutured or closed in one of the ways above described, can be treated by the insertion of a tampon to the point of perforation or by the establishment of a temporary gastric or duodenal fistula according to the method of Axhausen⁵ or Neumann,⁹² in which a rubber catheter first inserted through the perforation is subsequently surrounded by a funnel of omentum, forming a channel through which the contents of the duodenum may escape or food be introduced without incurring the risk of invasion of the general peritoneal cavity. Perforations which cannot be found may be treated by tampon or by a gastro-enterostomy, to which reference has already been made. F. Brunner¹⁶ collected 15 cases in which the perforation was treated by the insertion of a tampon, with only three deaths. In the majority of these cases a gastric fistula formed which subsequently closed spontaneously. On the other hand, in Petrén's¹⁰² much more valuable table of 92 cases, only three of 39 cases treated by tampon recovered, against 28 of 61 treated by suture which recovered, a result which leads Petrén to emphasize the undesirability of this method of treatment.

In regard to the excision of a perforating ulcer, the argument has been advanced that by this method the ulcer is definitely removed and therefore the risk of a recurrence of a perforation or of subsequent hemorrhage made impossible. It is necessary, however, to remember that excision of a perforation can in no way influence the course of a coexisting ulcer nor prevent either perforation or hemorrhage from taking place at such a point. As a matter of fact, simple suture of a perforation seems to be followed by as complete a cure of the affected ulcer as is accomplished by its excision. Evidence to demonstrate this fact is furnished by the interesting cases of Morton,⁹⁰ Fenwick,³⁴ and Marnoch.⁷⁴ Morton reports a case of the suture of a pyloric perforation 49 hours after it had occurred. There was general peritonitis at the time of operation. The patient died three months after from a complicating subphrenic abscess and an autopsy showed that the site of the sutured ulcer was marked by a scar and that a second perforation, shut off from the general cavity by adhesions, had taken place in a coexisting ulcer. Fenwick reports a death from general peritonitis 15 days after the suture of a perforation. Autopsy showed the ulcer to have entirely healed. Marnoch⁷⁴ lost a case of perforation from pyæmia nine weeks after it had been closed by suture. The autopsy showed no trace whatever of the ulcer. Steinthal¹⁰⁸ also reports a case in which three months after the suture of a perforation plus gastro-enterostomy, the patient died from a subphrenic abscess. The autopsy showed that the ulcer had entirely healed. Moreover, in perforations treated by suture, subsequent perforation or hemorrhage, rare as it is, does not usually take place at the point of suture, but from some coexisting ulcer. Finally, it must be remembered that excision can in no way remove the cause of ulceration whatever that may be, and that after successful excision, through the formation of new ulcers the patient may again be subjected to the risk of perforation, hemorrhage, or any other serious complication.

Whether the particular method of suture contributes in any way to the ultimate healing of an ulcer in which the perforation has been merely closed cannot be definitely stated, but it is quite conceivable that the purse-string suture, although it does not completely penetrate the wall of the stomach, may modify the circulation of the included segment to such an extent as to replace the ulcer with a healthy granulating surface which quickly heals, while the security of the sutured area is insured by one or more reinforcing Lemberts.

After the closure of the perforation, the adjacent part of the peritoneal cavity should be carefully cleaned. This can be done either by dry sponging or by local irrigation, the writer preferring the latter method. In no event should evisceration be practised. In cases of general peritonitis, the cleansing of the abdomen with abundant warm saline solution seems to be most efficient. It is of the utmost importance, especially in a condition of advanced peritonitis, that the entire period of anæsthesia should be curtailed as much as possible, and accordingly the cleansing of the abdomen should in these cases be rapid rather than complete. In this connection it is well to remember that the virulency of the infectious exudate, greatest near the point of perforation, rapidly decreases as the more remote parts of the peritoneal cavity are reached. It is, therefore, essential to cleanse with the greatest care the region of the stomach and the contiguous subphrenic spaces into which, almost from the very start, stomach contents have gravitated, while less attention may be devoted to the cleansing of that part of the peritoneal cavity below the level of the transverse colon. Subsequent drainage is essential only in those cases in which it is impossible to secure adequate cleanliness. The facility with which this may be accomplished depends upon the interval between the time of perforation and that of the operation, as well as upon the character of the exudate and the quantity of stomach contents which it contains. Usually, within the first six to eight hours after perforation, the peritoneum can be so thoroughly

cleaned that drainage is unnecessary. In the later cases, drainage is essential, especially of the subphrenic spaces. Apart from the immediate and frequently unavoidable peritonitis, no post-operative complication is more frequent or fatal than that of subphrenic abscess. Federmann³² cites three deaths out of a total of seven from this cause. Of F. Brunner's¹⁶ tabulated list of 470 cases, there were about 280 deaths, and of these 16 gastric and 1 duodenal perforation died from this complication, while in the 92 consecutive cases reported by Petrén¹⁰² no less than 6 of 69 fatalities were due to this cause.

As a matter of fact, the drainage of the subphrenic spaces is more difficult than that of any other part of the peritoneal cavity. Below the level of the transverse colon, drainage is unquestionably facilitated by the movement of the intestine and by the favorable action of the intra-abdominal pressure. Even of the pelvis satisfactory drainage can be provided through the suprapubic route without resorting to a counteropening in the rectum or vagina. On the other hand, above the transverse colon and especially above the level of the stomach, the absence of the small intestine and the modified abdominal pressure, together with the fact that the subphrenic spaces are bounded in part by more or less rigid walls, make the satisfactory drainage of these spaces a very difficult matter. To drain them against gravity is practically impossible, and it is only by the elimination of this factor that drainage becomes possible. This fact is abundantly proved by clinical experience and may be still further substantiated by laboratory demonstration. The best method of draining the subdiaphragmatic spaces is either one in which, by placing the patient in a suitable position, any infectious exudate or purulent material which they contain will flow toward the lower part of the peritoneal cavity and out through the abdominal incision, or by making a counteropening in the most dependent part of the affected space itself. The first method of drainage may be effected by placing the patient

in the "Fowler" position, but this sometimes fails to secure the desired result, especially in corpulent subjects as well as in those patients who, on account of great weakness, find it difficult to maintain the position for any considerable length of time. Of greater value than the Fowler position in maintaining effective drainage of the subdiaphragmatic spaces is the simple prone position. This, however, is extremely uncomfortable to the patient and cannot be assumed for any length of time without material discomfort. To obviate this objection, the writer is at present interested in the designing of a suitable bed or apparatus in which the prone position may be indefinitely maintained without complaint from the patient. If necessary, effective drainage can usually be secured by making a counteropening through the lower posterior pleural space. This operation in a patient necessarily in a weakened condition may not safely be tolerated and should therefore be done only after all other means fail. Under such conditions the operation, if successful, yields satisfactory results.

In order to determine the relative value of drains themselves experiments have been recently made in the laboratory of the hospital by my assistant, Dr. Jameson, with the following results:

1. Gauze and cigarette drains will drain only thin fluids.
2. Very tightly rolled gauze drains are not quite as good as those more loosely rolled.
3. Gauze and cigarette drains will drain the fluid from pus but none of the solid material even with the assistance of gravity or suction.
4. Lampwicks are of no value as drains.
5. The most efficient drain is a soft rubber tube with a gauze strip inside. The gauze should not fill the entire lumen.
6. Any form of suction attached to a drain improves its efficiency.

In Case XI herewith reported the drainage of both subdiaphragmatic spaces was satisfactorily accomplished with the patient in the supine position by attaching a siphon drainage

apparatus to the end of two rubber tubes which passed down a distance of six and eight inches, respectively, through the epigastric incision into the right and left loin.

After the necessary cleansing and drainage of the peritoneal cavity, the question of adding a gastro-enterostomy to the measures undertaken for the closure of the perforation is one of vital interest and importance.

In the first place, there is a group of cases in which a gastro-enterostomy is urgent, namely, in those in which the closure of the perforation, in whatever way it has been accomplished, results in such a constriction of the pylorus or duodenum as to interfere with the passage of the gastric contents into the intestine. The writer is convinced, however, that such a contingency is very unusual and that in many cases in which a gastro-enterostomy has been done on that account, the food would have had very little difficulty in passing beyond the point of supposed constriction had the gastro-enterostomy been omitted. It must be remembered that the gastric contents pass through the pylorus and duodenum in a fluid condition, and that this is especially the case when, after gastric operations, the diet is naturally restricted for some time to fluids only. If the perforation involved an ulcer of recent formation without the encroachment of previous cicatricial tissue on the lumen of the pylorus or duodenum, it is safe to infer that any perforation could be closed by suture without the danger of subsequent constriction. Even in perforations of large size in indurated ulcers, successful closure has been accomplished without gastro-enterostomy. Thus Jopson⁵³ reports the successful suture of a ragged pyloric perforation admitting the gloved index-finger in the centre of an area of induration, the patient being quite well two years afterward. On the other hand, the closure of a perforation in an old callus ulcer, which in itself has led to considerable previous cicatricial contraction, may so diminish the lumen of the viscus as to make a gastro-enterostomy necessary. The writer recalls one instance, however, in which, after a history of more than

20 years, a greatly emaciated patient (and yet not complaining of the subjective symptoms of starvation) was admitted to the hospital with a diagnosis of carcinoma. Subsequent examination showed a condition of chronic ulceration of the pyloric and duodenal junction with cicatricial stenosis so advanced that for a distance of at least one inch the lumen of the intestine was only sufficiently large to admit a lead-pencil. This advanced lesion had been of slow formation, and it is quite conceivable that, had it been of more rapid development, acute obstruction would have ensued. That such extreme stenosis does not necessarily interfere with the passage of gastric contents into the intestine in quantity sufficient to maintain life, is certainly worthy of comment. In this connection it is of interest to note how great a degree of constriction of the first part of the duodenum can be produced without primarily interfering with the passage of food or secondarily leading to compensatory hypertrophy, with or without dilatation, of the stomach.

In order to investigate this question, nine cats were operated upon, of which one died of peritonitis caused by leakage and two others from diseases not connected with the digestive tract. In the remaining six the method employed was to excise from one-quarter to two-thirds of the circumference of the duodenum, suture the gap, and allow the cats to live six months.

Following the operation, all the cats showed progressive improvement and gain in weight, variations being directly traceable to external influences. Two cats vomited on the day after operation, and one other refused most of its food for a week.

At the end of six months examination of the removed specimens showed a negligible enlargement of those stomachs where two-thirds of the circumference of the duodenum had been removed. The duodenum showed only a slight constriction at most, and in those cases where small amounts were excised none whatever. Some difficulty was experienced in locating the spot where the excision had been made because of the comparatively normal appearance of the duodenum. There was in some cases a puckering of the mucosa and slight induration at the site of the scar. Microscopically, examination revealed in two cases complete regeneration of epithelium and in a third a covering of degenerated epithelium.

Conclusions: It is not possible in the cat by partial excision of the wall of the duodenum to produce a permanent marked constriction of its lumen or a resulting dilatation of the stomach.

In the cat the duodenal wall is so thick as compared with the diameter of the bowel that after removal of two-thirds of the circumference of the duodenum so little mucous membrane remained that suture of the edges of the opening was extremely difficult. Notwithstanding this immediate constriction produced by the operation, the wall subsequently stretched sufficiently to make the diameter of the duodenum practically uniform.

Doctor W. G. MacCallum (personal communication), in attempting to produce partial pyloric obstruction in dogs has had a similar experience.

Subject	Weight at operation	Amount removed	Weight after six months	Degree of dilatation of stomach	Degree of constriction of duodenum	Appearance of site of excision	Microscopical examination
1	Gm. 2720	$\frac{3}{4}$	Gm. 3900	Very slight	Very slight	Induration puckering	Covering of degenerated epithelium.
2	2050	$\frac{1}{2}$	3020	o	o	Negative	Normal.
3	2280	$\frac{1}{2}$	3350	o	Very slight	Negative	
4	1900	$\frac{3}{4}$	2250	Slight	Slight	Groove in mucosa	Normal.
5	2420	$\frac{1}{2}$	3400	o	Very slight	Induration puckering	
6	2830	$\frac{3}{4}$	3680	o	Slight	Induration	

All the cats were in poor condition when received.

A second group includes those desperate or neglected cases in which there is an advanced peritonitis at the time of operation. The most enthusiastic champion of gastro-enterostomy after closure of a perforation would unquestionably concede the propriety of its omission under such circumstances.

A third group includes all cases in a favorable condition in which closure has been accomplished without undue constriction and in which there is no advanced peritonitis. The adherents of a gastro-enterostomy in cases of this character advance the following arguments for its performance. They believe that it is of immediate benefit in that it (a) prevents undue tension on the closed perforation and thereby obviates the danger of the yielding of the suture; (b) that it diminishes the danger of perforation in coexisting ulcers; (c) that it diminishes the risk of hemorrhage from coexisting ulcers; (d) that it increases the probability of the healing of

coexisting ulcers; (*e*) that it favors the early and prompt post-operative nutrition of the patient; (*f*) that it may prevent the further escape of gastric contents from a perforation which cannot be located, by providing means of their rapid and direct passage into the intestine.

They further assert that its benefit is lasting and permanent in that (*a*) it prevents the remote perforation of coexisting ulcers; (*b*) that it forestalls the effect of cicatricial contraction and the consequent stasis of food. In other words, that it has the same beneficial effect as a gastro-enterostomy which is done in the absence of a perforation.

On the other hand, the arguments advanced by many observers against a gastro-enterostomy may be grouped as follows: (*a*) it prolongs an operation which is one of emergency and which it is always desirable to conclude in the shortest possible time; (*b*) that it subjects the patient to the added risk of infection of the lesser peritoneal cavity; (*c*) that patients in whom a gastro-enterostomy is done are not always relieved of their gastric symptoms; (*d*) that patients treated by suture only frequently suffer from no recurrence of their symptoms; (*e*) that in those cases of perforation treated by suture only, in which the symptoms of gastric ulcer either persist or recur, a gastro-enterostomy can be done more safely than at the time of perforation; (*f*) that patients in whom a gastro-enterostomy is added to the closure of a perforation are subjected to the risk of a subsequent peptic ulcer in the jejunum.

These different arguments in favor of and against a gastro-enterostomy are worthy of most careful consideration.

In regard to the possibility of the yielding of the suture in those cases where a gastro-enterostomy is omitted, it may be said that, theoretically, the occurrence of more or less powerful muscular contraction in a moderately distended stomach ought to result in the tearing out of the suture and the recurrence of the perforation. As a matter of fact, however, experience shows that this accident rarely if ever occurs, and

in those patients who die from peritonitis or other cause the autopsy frequently records the fact that the sutures closing the perforation are intact. Thus in Brunner's¹⁶ extensive statistics no mention of the giving way of a sutured perforation occurs, although he refers to 12 cases in which a fatal issue resulted from the perforation of a coexisting ulcer on an average of eight days after the original perforation had been closed. Furthermore, a search of Petré's¹⁰² histories shows 13 instances in which in the autopsy findings the definite statement is made that the sutures had held, while in only one the sutures are reported to have given way. In this instance the original perforation had been found after considerable difficulty on the posterior surface of the stomach near the cardia and the orifice "was closed as well as possible." Evidently the perforation had proved relatively inaccessible and its closure correspondingly defective. The giving way of the sutures has never taken place in the writer's experience, and if closure of the perforation is made with a purse-string suture reinforced by at least two Lemberts the writer believes it is unlikely to occur. If the security of the suture is endangered through the friability of the adjacent tissue, it can readily be strengthened by the superposition of an omental flap, a procedure otherwise unnecessary and having the disadvantage of predisposing to secondary ileus.

Gastro-enterostomy probably diminishes the danger of the perforation of coexisting ulcers by facilitating the passage of the gastric contents into the intestine. F. Brunner¹⁶ mentions 12 perforations of this character occurring within one month after the suture of the primary perforation. On the other hand, the fact that an added gastro-enterostomy does not necessarily protect against perforation is demonstrated by the cases reported by Schoemaker¹⁰⁵ and Dahlgren²⁴ (two cases). Furthermore, it is a well-known fact that perforation may occur in stomachs shortly after a previous gastro-enterostomy for ulcer, either at the point of anastomosis or in some remote portion. Thirteen instances of such perforation, collected from

the literature, including those reported by the writer in his previous paper, are reported below.

That a gastro-enterostomy added to the closure of a perforation diminishes the probability of subsequent hemorrhage from coexisting ulcers is quite untenable. F. Brunner¹⁶ reports eight cases of this character after the closure of perforation by suture and to this number must be added one reported by Wallis,¹¹⁷ one by Heussler,⁴⁵ and three by Petré.¹⁰² On the other hand, three instances of this accident occurring in cases in which simultaneous gastro-enterostomy was done, reported by Steinthal,¹⁰⁸ Mühsam,⁸⁶ and Dahlgren,²⁴ may be cited.

Additional testimony adverse to the efficacy of gastro-enterostomy in protecting patients against this accident is furnished by the experience of Krogius,⁵⁰ Küttner,⁶³ and Albrecht.¹²⁴ Krogius reports three cases in one of which secondary hemorrhage occurred six days after a posterior gastro-enterostomy and two cases in which this accident was fatal one day and three weeks respectively after an anterior gastro-enterostomy with entero-anastomosis. Küttner reports two cases in which a fatal hemorrhage occurred one day and three weeks respectively after a gastro-enterostomy, of which the type is not mentioned. Albrecht also reports two cases in which hemorrhage led to a fatal issue two and three days after an anterior gastro-enterostomy with entero-anastomosis and a posterior gastro-enterostomy respectively.

That a simultaneous gastro-enterostomy increases the rapidity with which coexisting ulcers heal is necessarily conjectural. Although it is quite probable that the healing of coexisting ulcers in the pyloric and duodenal zones is thereby hastened, other ulcers between the gastro-enterostomy orifice and the cardia could be favorably affected only through the diminution or prevention of hyperacidity.

That simultaneous gastro-enterostomy permits earlier feeding of the patient than in those cases in which the perforation is merely closed would not be granted by many observers.

In the early days of gastro-enterostomy, the question of post-operative feeding was approached with fear and trembling. At present the general custom is to give small quantities of food by mouth as early as 15 to 20 hours after operation, and, if tolerated, this amount is rapidly increased. The writer has adopted a precisely similar method of feeding in cases of perforation and has never seen an accident after its use. Only in those cases in which the stability of the sutured perforation may be insecure through tissue friability is special caution necessary, and as has already been mentioned, even then the sutures are not likely to give way. To show the time at which the post-operative feeding is begun the writer has taken the following extracts from the histories of the cases reported in his previous paper and those reported now for the first time:

CASE 1: Perforation anterior wall three inches from the cardia; 1903. Albumin, water, and kumyss at the forty-eighth hour.

CASE 2: 1904; perforation on the anterior surface of the pylorus. Peptonized milk on the fourth day.

CASE 3: 1905; duodenal perforation. Water and kumyss three and one-half days after perforation.

CASES 4 and 5: No record.

CASE 6: 1907; duodenal perforation. Full fluids the twenty-fourth hour.

CASE 7: 1907; duodenal perforation. Water, broth, and beef tea at the thirty-sixth hour.

CASE 8: 1908; duodenal perforation. Sips of water sixteenth hour. Fluids without milk thirty-sixth hour.

CASE 9: 1910; pyloric perforation. Small quantity of water fourteenth hour; Lenhartz diet thirty-sixth hour.

CASE 10: 1910; pyloric perforation. Ice and water fourteenth hour. Lenhartz diet sixtieth hour.

CASE 11: 1911; pyloric perforation. Hot water fourteenth hour. Milk and brandy thirty-eighth hour.

CASE 12: 1911; gastric perforation near pylorus; treated as in Case 11.

A careful consideration and analysis of the preceding facts seem to indicate that, on the whole, the immediate advantages of supplementing the suture of a perforation with a gastro-enterostomy are at best but very slight and not at all likely to contribute materially to the patient's recovery.

(To be continued.)

THE REPAIR OF HERNIÆ FROM THE PERITONEAL SIDE OF THE ABDOMINAL WALL.

BY E. H. BECKMAN, M.D.,

OF ROCHESTER, MINNESOTA,

Assistant Surgeon to St. Mary's Hospital.

It often becomes necessary to operate for abdominal conditions upon patients who also have either femoral, inguinal or umbilical herniæ. For a number of years in such cases it has been the practice in St. Mary's Hospital (Mayo Clinic) to repair these herniæ from within the abdomen, provided they are not of enormous size. The operation was first used in repairing femoral herniæ, and is similar to the Ochsner operation for this condition. The following is a description of the technic in a case of femoral hernia.

After the primary operation has been completed, the abdominal wall is retracted on the side of the hernia so that the femoral ring is exposed. A pair of artery forceps are then introduced through the hernial ring from within the abdomen to the bottom of the sac. The sac is grasped with these forceps and pulled back into the abdomen. Two or three mattress sutures of heavy linen or silk are then passed completely through the neck of the sac and tied. The remaining portion of the sac can then be either excised or stitched to the abdominal wall.

The most essential factor in the cure of a hernia is to obliterate the sac, and it will be seen that, following this operation, the sac is completely obliterated, and it is impossible for it to reinvert through the femoral ring.

In the cure of inguinal herniæ by this method, only those cases in which the sac is of small size are suitable, that is, the entire sac must necessarily be pulled back into the abdomen and the pillars of the internal ring sutured with mattress sutures of linen or silk, similar to the femoral hernia just described.

In treating umbilical herniæ by this method, it has been our custom, on most occasions, to re-invert the sac of the hernia as described, although, in some instances, we have simply stitched up the ring with mattress sutures of linen, paying no attention to the sac, and have obtained equally good results.

CONGENITAL MALFORMATIONS OF THE URETERS.

BY DANIEL N. EISENDRATH, M.D.,

OF CHICAGO, ILLINOIS.

THE object of the present paper is to add another case of congenital malformation of the ureter to the series of four similar cases reported by the writer in two previous articles, published during the past year.¹

In order to permit of a survey of the entire five cases, and to bring out the various forms and clinical pictures shown by them, I will give a brief synopsis of the already published first four cases.

CASE I.—*Congenital Hydronephrosis of a Horseshoe Kidney.*

Boy of six, with severe right abdominal pain, septic symptoms, and palpable transverse tumor (Fig. 1) in upper abdomen. Later at operation seen to be a hydronephrotic horseshoe kidney. Ureter not enlarged. Operation consisted of draining sac. Existence of closure or narrowing of ureter at junction with renal pelvis to be assumed from absence of dilatation of ureters and from similar cases collected by Papin and Christian.² They found that the cause of the hydronephrosis in fifteen cases of hydronephrotic horseshoe kidneys seen at autopsy was either congenital stricture or faulty insertion of the ureter. In this case the condition had remained latent until infection occurred.

CASE II.—*Congenital Hydronephrosis Due to Stricture at Ureteropelvic Junction.*

Boy of twelve, with enlargement of left side of abdomen, only noticed after sixth year (Figs. 2 and 3). No symptoms referable to urinary tract. Soft elastic retrocolic tumor to be felt to left of median line, extending from costal arch to Poupart's ligament, and having distinct notch. Urine very turbid and con-

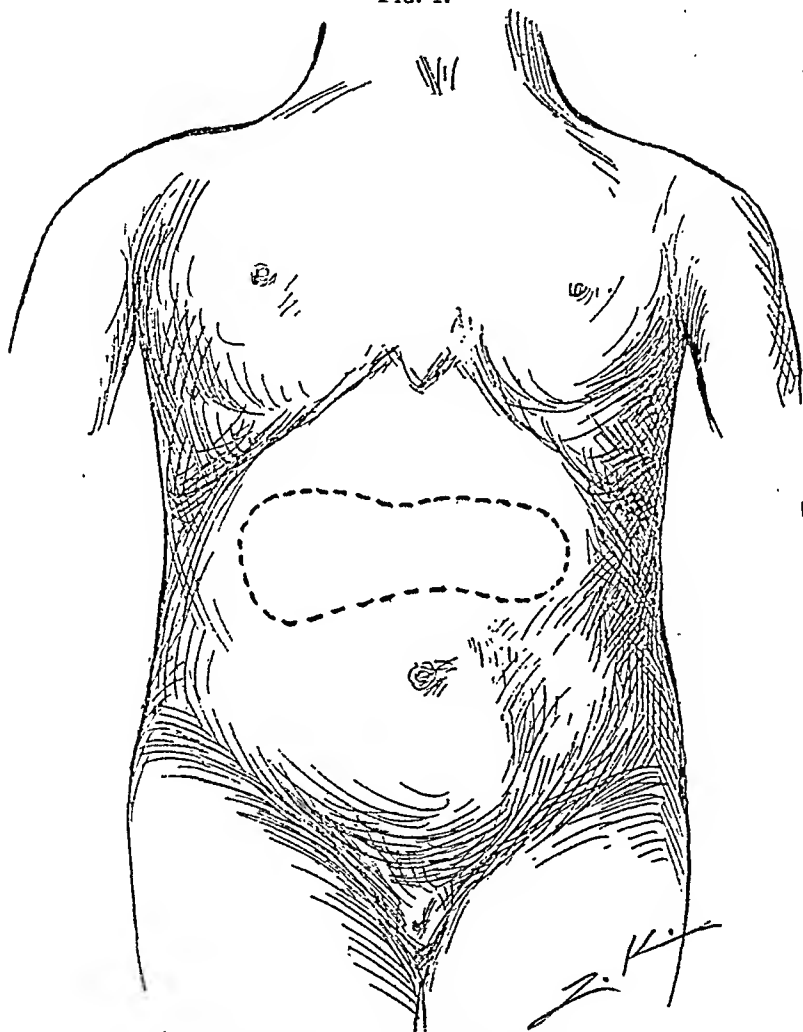
* Read before the Western Surgical Association, December 21, 1911.

¹ Surgery, Gynæcology and Obstetrics, June, 1911, and Jour. A. M. A., July 8, 1911.

² Annales des Mal. d. Organes Genito-Urin., vol. xxviii.

tained many pus corpuscles. No fever or other evidence of infection, only marked malnutrition. At operation an immense hydronephrotic kidney was found. The sac contained two quarts of turbid fluid, which showed no growth on the ordinary media. The pelvis and calyces were enormously dilated at the expense

FIG. 1.



Outline of hydronephrotic horseshoe kidney on abdomen (Case I).

of the parenchyma (Fig. 4.). The cause of the obstruction was found to be a sudden narrowing of the ureter (Fig. 5) at its junction with the renal pelvis. It was impossible even to pass a filiform bougie through the ureteral lumen at the point of obstruction. After removal of the kidney, patient made an uneventful recovery, and has remained well.

FIG. 2.

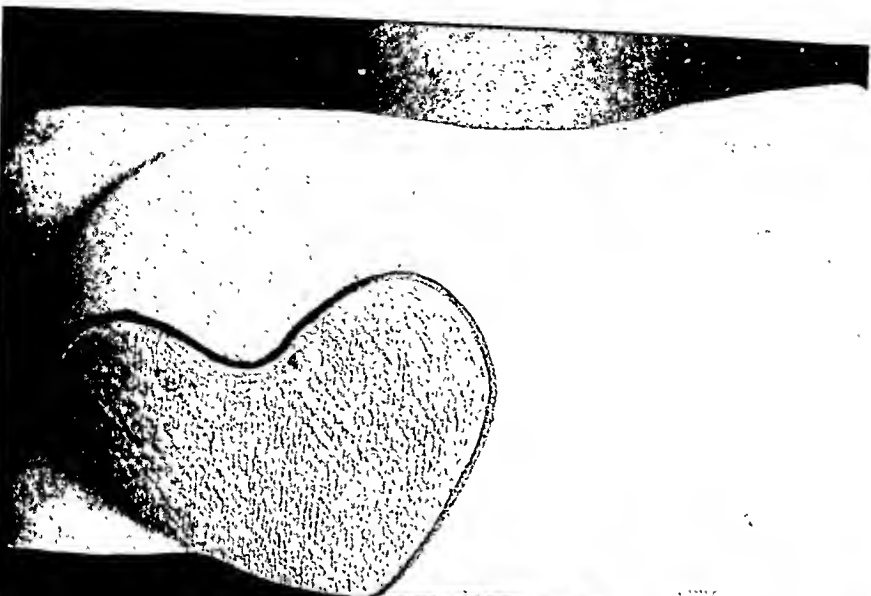
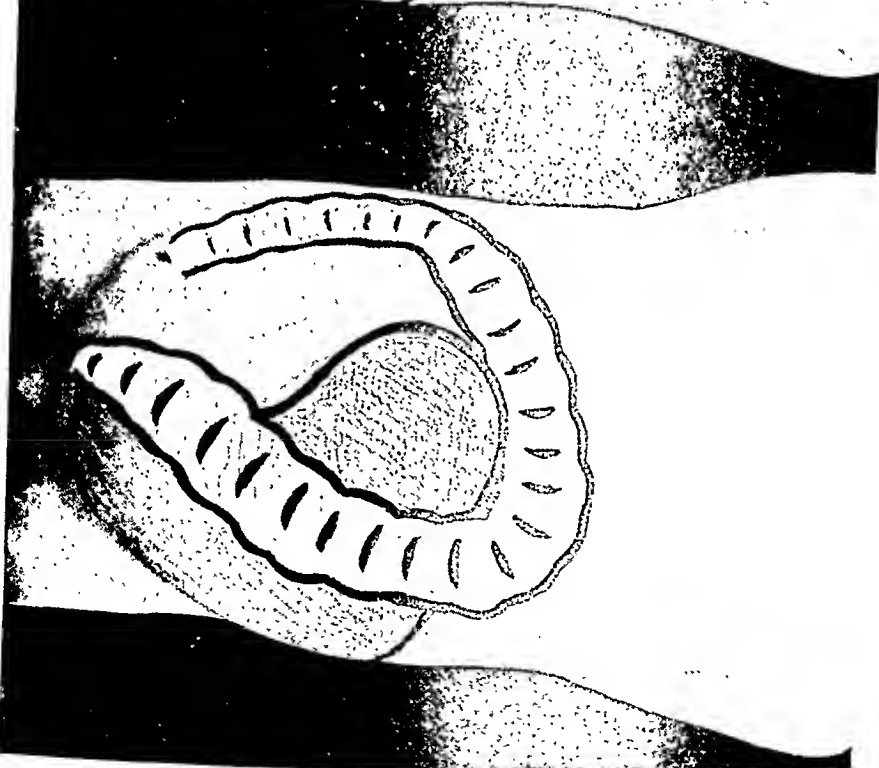


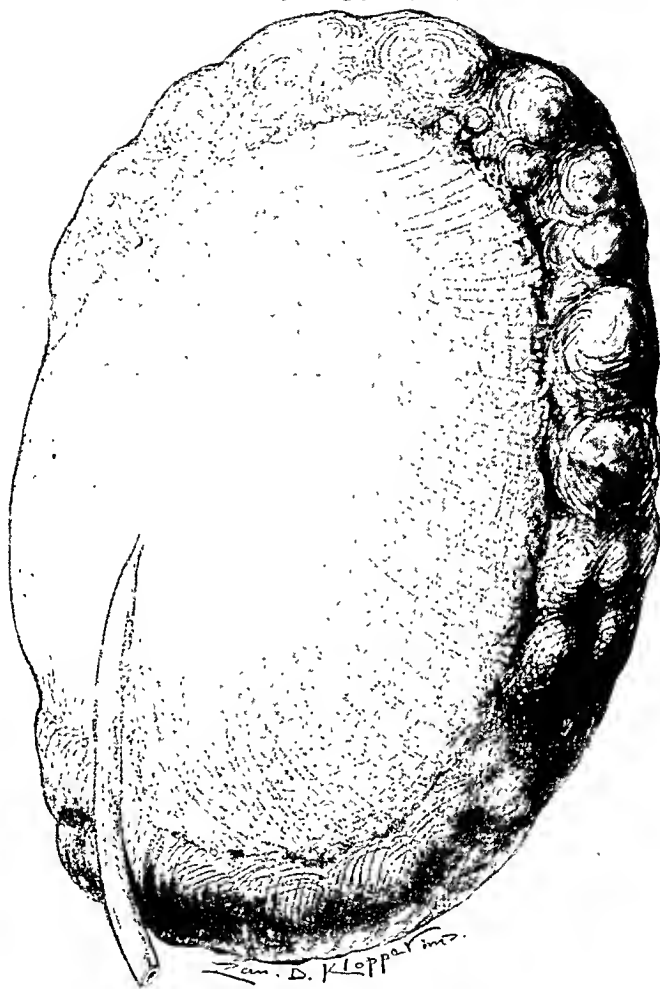
FIG. 3.



Front view of abdomen in congenital hydronephrosis (Case II).

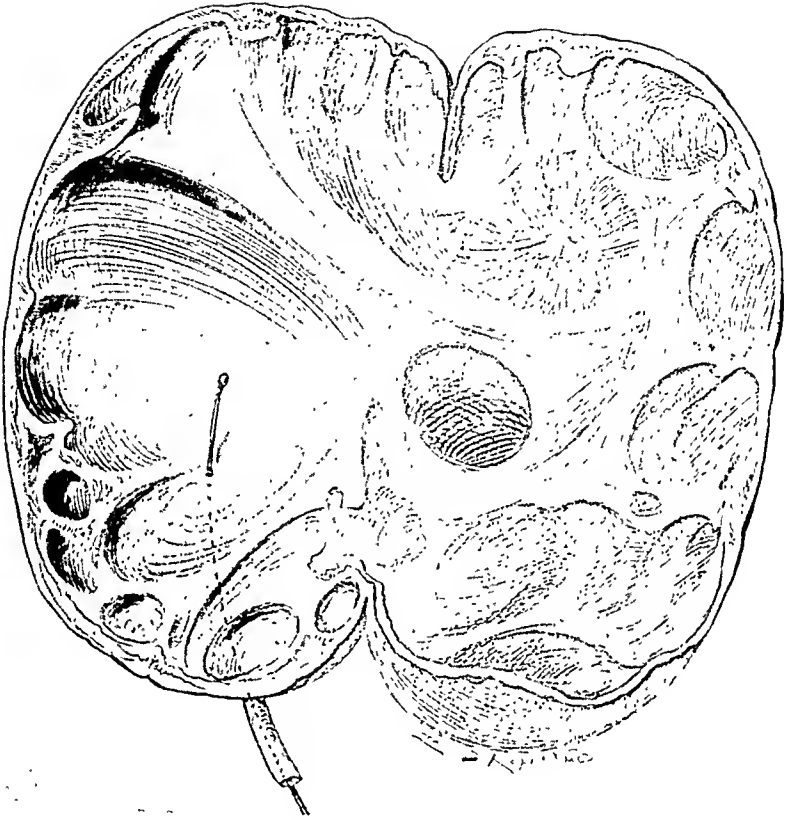
Result of inflation of colon in Case II.

FIG. 4.



Front view of kidney of Case II. This shows the enormous dilatation of the pelvis and the narrow margin of parenchyma with prominences due to dilated calyces. Note narrowness of ureter at junction with pelvis.

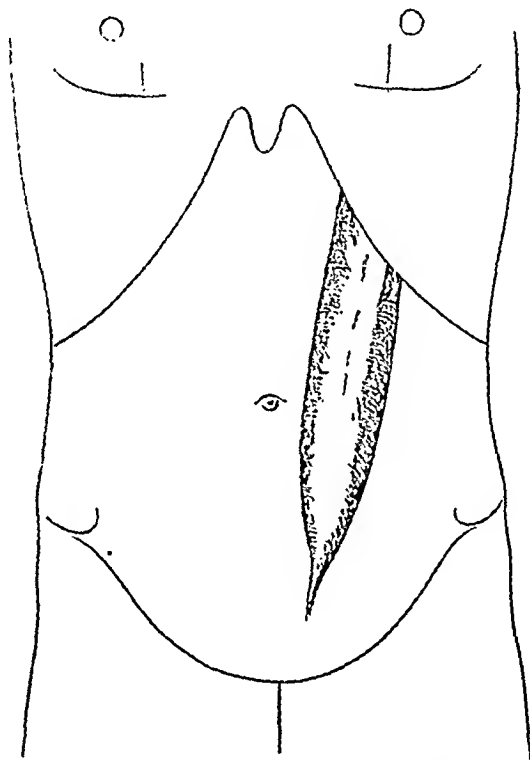
FIG. 5



Interior view of kidney of Case II. Note narrow rim of kidney tissue, dilated calyces and pelvis, and small orifice of ureter (probe inserted through ureter).

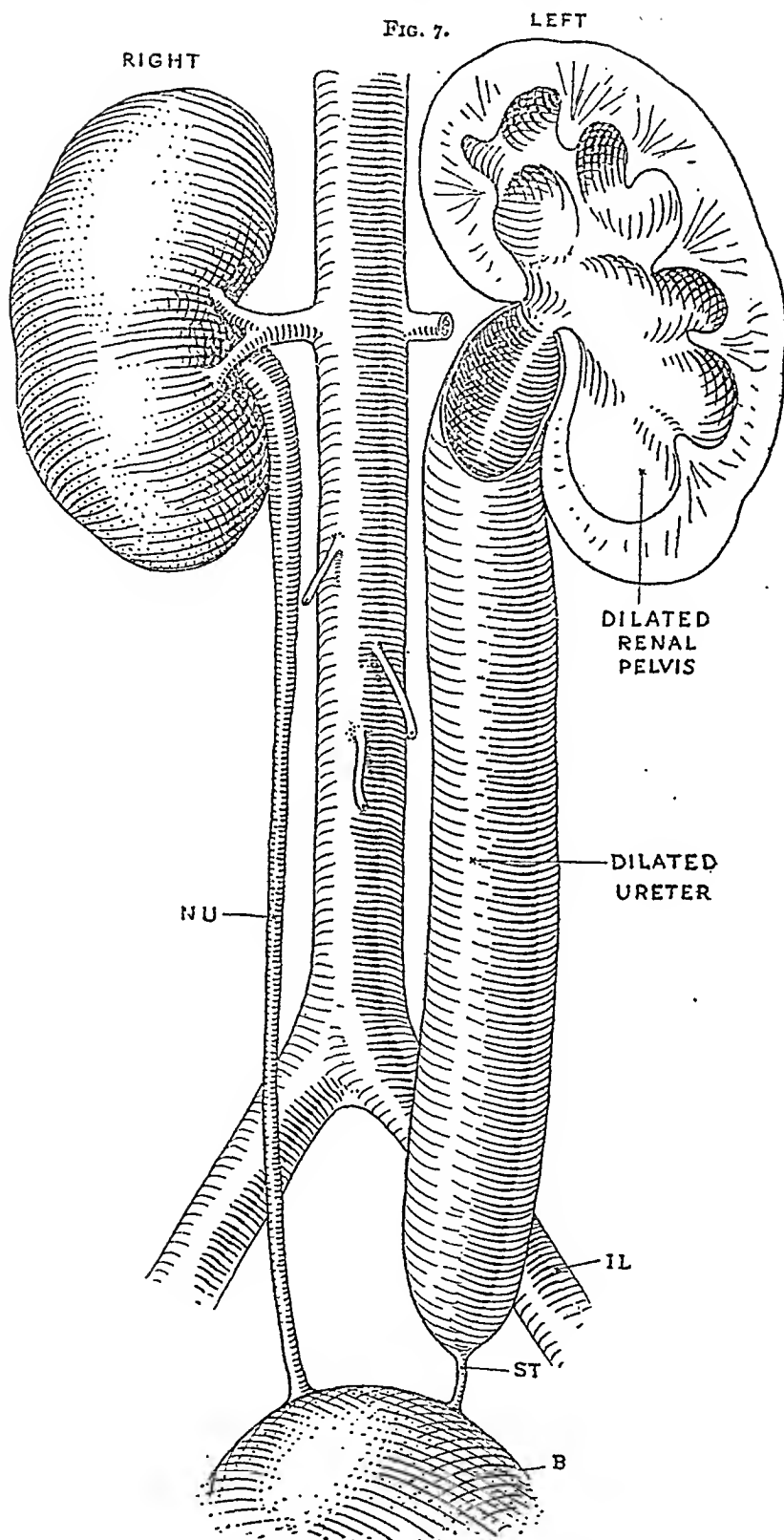
CASE III.—Boy of fourteen, previously well, was suddenly seized with left-sided abdominal pain. Latter was most marked in the left iliocostal space and radiated toward front of abdomen. Temperature 101° . Left side of abdomen rigid. Urine contained a few pus corpuscles. Urinary retention was present, so that it was necessary to catheterize. No cystoscopic examination or collargol injection of the ureter was made. Diagnosis before operation was some left intraperitoneal infection, possibly appendix or diverticulitis of sigmoid. Under anæsthesia spindle-

FIG. 6.



Spindle-like tumor felt on outer side of left rectus (under anæsthesia). It tapered toward pelvis. (Case III).

like tumor (Fig. 6) to be felt beneath left rectus muscle, tapering sharply toward true pelvis. When peritoneal cavity was opened, a translucent, elongated, fluctuating enlargement was found lying behind the peritoneum, to the inner side of the descending colon. Ureter exposed through usual oblique incision. Tissues around ureter found œdematous, as if the seat of a recent infection, and upon incision a slightly turbid serum escaped. No cultures were made. Ureter dilated to size of small gut, with walls extremely thin and easily torn. Dilation showed gradual narrowing at



Author's case of congenital stenosis of left ureter (see text). *NU*, normal right ureter; *IL*, iliac artery; constriction (*ST*) was just distal to place where ureter passes across vessel. *B*, bladder. (Semidiagrammatic.)

junction with renal pelvis above, and a quite sharp termination at lower end, just below brim of true pelvis (Fig. 7). From this point downward ureter felt hard and fibrous, but allowed an ordinary ureteral catheter to pass through into bladder. The ureter above this narrower pelvic portion was found to be of tissue-paper thinness, with markedly œdematous and reddened mucous membrane. At about the middle of the enlargement two distinct mucous valves were seen, which did not cause any obstruction. Ureter at first drained, but recurrence of fever, which became quite high, necessitated removal of dilated ureter and kidney. The ureter was distinctly narrowed at its junction with the renal pelvis (Fig. 7). There were marked evidences of a recent pyelonephritis, many groups of small abscesses being scattered over the renal cortex. Patient made an uneventful recovery, and has remained well up to present time (eighteen months after operation).

CASE IV.—Specimen of kidney, loaned by Dr. I. A. Abt. Kidney, ureter, and bladder from a child, ten days old, who had died of icterus neonatorum. The left ureter (Fig. 8) showed two distinct points at which its lumen was impermeable, even to the very smallest bougie. The proximal of these two strictures of the left ureter is one-half inch below the renal pelvis. The distal stricture of the left ureter is one-eighth of an inch above the bladder. A similar proximal stricture was found in the right ureter, five-eighths of an inch below the ureteropelvic junction. There is no distal stricture of this left ureter. There is a marked spindle-like dilation of the ureter, and there is also marked dilation of the ureter and renal pelvis (moderate hydro-nephrosis) on both left and right sides above the proximal strictures.

The following case was observed since the publication of the preceding four:

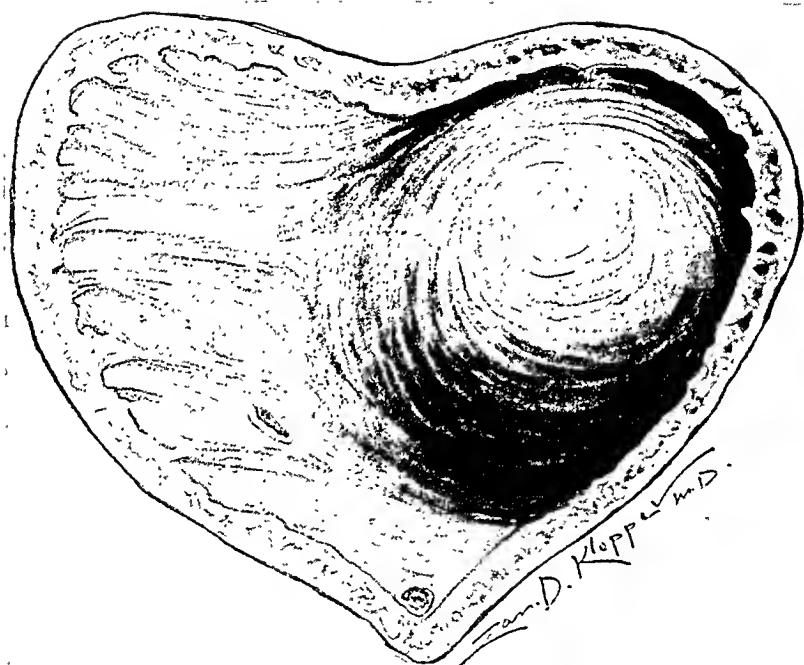
CASE V.—Girl of sixteen, but with physical and mental development of child of six, was admitted to the service of Dr. I. A. Abt, in the Michael Reese Hospital. She had always been backward in intelligence and size, and showed all of the stigmata of cretinism. Her history was that of the sudden onset of severe pains in the abdomen, accompanied by frequent vomiting. This condition had lasted for about two weeks prior to her admission.

The abdomen was enlarged and soft. There was tenderness and a feeling of resistance, or of a mass over the right kidney, but nothing definite. No evidence of free fluid to be found. She was transferred to the surgical service of the writer, with the diagnosis of a probable right kidney tumor. My examination, in addition to confirming the presence of marked retardation of mental and physical development, showed the presence of a suprapubic soft enlargement, which entirely obscured the possibility of palpating the tumor previously thought as present by Dr. Abt. Owing to her irritability and the inability to reason with her, it was impossible to obtain any urine or to make a satisfactory abdominal examination until she was anæsthetized. Upon inserting a catheter, a very large amount of turbid urine was evacuated and the greater part of the suprapubic enlargement disappeared. Our suspicion entertained before anæsthesia, that the suprapubic enlargement was due to a greatly distended bladder, seemed at first to be confirmed. But in spite of suprapubic pressure, the catheter being left in the bladder, some enlargement remained, and I decided to open the abdomen in the median line and explore the peritoneal cavity. This was done and showed that both ureters were dilated, the left one far more so than the right. The left ureter could be seen to be about the dimension of the adult thumb. The enlargement seemed to be uniform, *i.e.*, it extended without any narrowing to the kidney above and bladder below. The corresponding (left) kidney was the size of the adult fist and markedly hydronephrotic, showing a number of translucent prominences corresponding to dilated calyces. The right ureter was about the size of a lead pencil, and much less translucent than the left one. The right kidney was only slightly hydronephrotic. No cause for the obstruction in the left ureter was found *proximal* to the bladder. The latter could still be felt to be considerably enlarged, so the first incision was closed and a second lower extraperitoneal opening made, just above the pubes, the bladder brought into wound, and opened. A very large quantity of turbid urine escaped. The walls of the bladder were greatly hypertrophied and a projection into the lumen was to be distinctly seen on the left side (Fig. 9). It looked like an elevation of the bladder wall covered by smooth mucosa, which seemed to fill up almost the entire bladder, projecting beyond the median line and



Specimen obtained at autopsy from Dr. Aht's case of infant, 10 days old, who had died of icterus neonatorum. Note narrowing of ureter just above bladder and again just below renal pelvis. Proximal to each one of these narrowings or stenoses is a marked discoloration. (Case IV.)

FIG. 9.



Appearance of bladder at operation. Cystiform protrusion seen on left side (retracted so as to show relation to right ureteral orifice and to internal meatus). (Case V.)

anteriorly, so that it was necessary to hold it back with a retractor to expose to view the right ureteral orifice and the internal meatus, both of which this prominence covered.

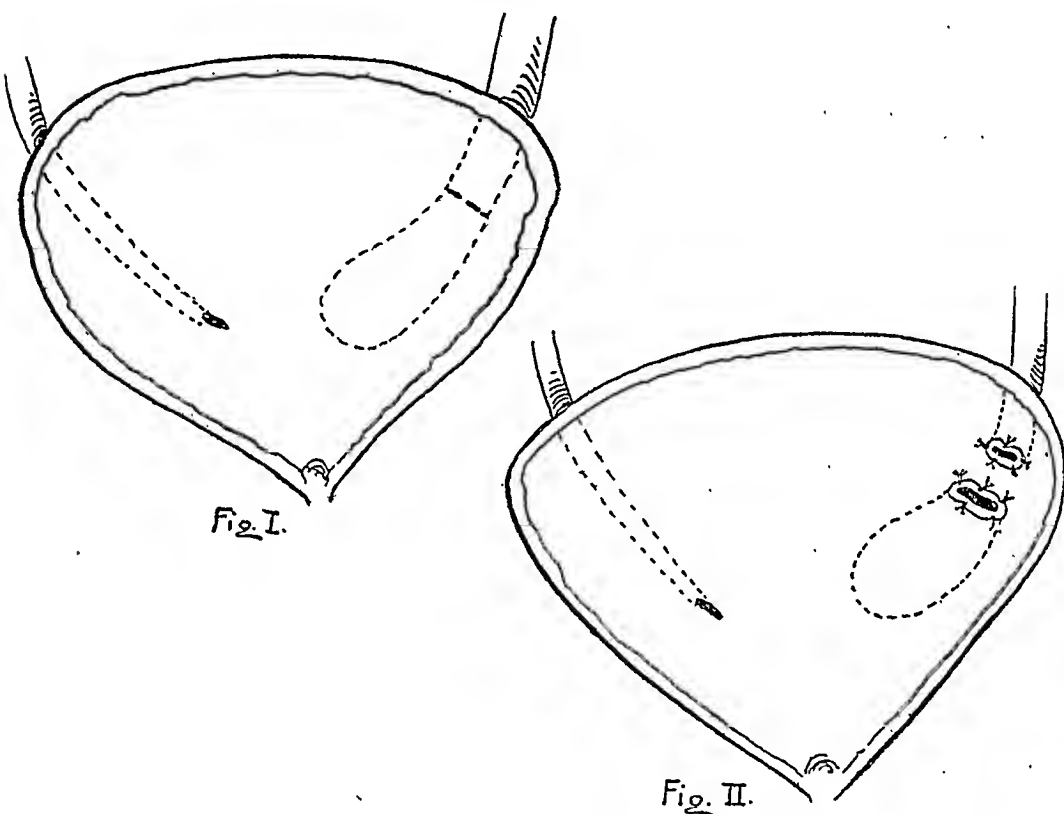
It looked not unlike the bulging of a rectocele, seen in a case of marked perineal tear. Examination of the right ureteral orifice and internal meatus showed that both were permeable in a normal manner. Most careful search was made for a left ureteral orifice, but none found. A diagnosis of cystiform protrusion of the lower end of a congenitally closed ureter was made, and a plastic operation begun, so as to create a permanent left ureteral opening into the bladder.

The mucous membrane covering the cystiform protrusion was incised and the greatly dilated ureter exposed. This was opened and divided transversely into a proximal and distal portion, the point of division being about one and a half inches above the lower end of the dilatation. The new ureteral openings were formed by uniting the mucous membrane of the bladder, as shown in Fig. 10, with the wall of the divided ureter. Although a probe was shown to have a wide range of movement in the distal portion of the cystiform protrusion of the ureter, no communication with the bladder lumen was found. A case of Bostrom's, reproduced in Fig. 16, will give one the best idea of the condition, as found by us at operation. The ureter opened widely into the protrusion, and I thought it advisable to establish a permanent means of communication (Fig. 10) between the distal portion and the bladder lumen, in order to permit of drainage of this distal pocket. It would, of course, have been ideal to make the new and only ureteral opening at the distal end of the dilatation, but it was impossible to find this end until we had made our incision through the posterior bladder wall and opened the ureter at a point a little higher up. This case, so far as I can learn, is the first one in which an intravesical ureterostomy for a congenital cystiform protrusion was performed. That the opening remained perfectly patent was shown by the fact that it was found to admit a No. 5 English soft rubber catheter at the autopsy, held nearly four months after this ureterostomy operation.

The only manner in which I can explain the retention of urine, resulting in the suprapubic tumor felt before this first operation, is that the cystiform protrusion, filled with urine, so filled up the

bladder lumen as to obstruct, not only the internal meatus, but also the right ureteral orifice. Before we could expose the right ureteral orifice, in order to determine its permeability to a catheter after opening the bladder, we were obliged to strongly retract the cystiform protrusion to the left. It is my opinion that the urine from this left kidney probably passed by filtration into the bladder lumen or through some minute opening which

FIG. 10.



Plastic operation to correct cystiform protrusion. I, course of both ureters before ureterostomy (note dilated lower end of left ureter). II, method of suturing proximal and distal portions of ureter into bladder.

we did not find. It would seem reasonable to expect a very much more marked hydronephrosis on the left side, if none of the urine had escaped during the sixteen years of her life.

After this ureterostomy, on May 20, 1911, both laparotomy and suprapubic wounds healed very slowly. From May 20 until June 20, the temperature was practically normal, seldom rising as high as 100° F. Beginning June 20, the temperature began to rise, reaching its first high point on June 26 (102.5° F.).

From this date to July 20, there were four febrile periods, lasting on an average from two to four days, with intervals of two to three days. The diagnosis of ascending infection, from the bladder, of the left kidney was made. An exploratory operation to determine the condition of this kidney was decided upon. This was performed on July 25, 1911.

The kidney was brought into the abdominal wound. Its cortex showed a very large number of deep hemorrhagic spots, and at the upper pole there were a number of pin-point yellowish pus foci. Both of these findings confirmed the diagnosis of a pyelonephritis. It was at first thought possible to save the kidney by simply incising these pus foci, but owing to the spiral twist of the ureter described below, this was deemed inadvisable. It was found that the pelvis of the kidney was quite large compared to the size of the kidney itself. This enlargement extended down into the upper portion of the ureter, which was also greatly dilated down to a point about 4 cm. below the kidney. The form of the enlargement was like that of the bowl of a pipe. The enlargement stopped suddenly at a point where the ureter seemed obstructed by a *complete spiral twist of over 180 degrees* (Fig. 11). There was a second spiral twist about 2 cm. below this one. On account of the infected condition of the kidney and the difficulty of performing a plastic operation to join the ureter at a point below its second spiral twist with the pelvis of the kidney, it was deemed best to perform a nephrectomy. Before performing this, search was made for the possibility of an accessory vessel which could cause an obstruction of the renal pelvis, but none was found. The description of the removed kidney and removed ureter is as follows:

Left kidney and ureter removed July 25, 1911.
Ten cm. long by 4.5 wide by 2 cm. thick. Fetal lobulations were well marked. The cortex showed innumerable petechiæ at the upper pole and there were a number of pin-point areas which, on section, were seen to be small pus foci in the cortex. Surface of cortex rough and somewhat nodulated. Section showed renal pelvis greatly dilated and a moderate degree of hydronephrosis.

* Both the upper or major and the lower or minor twists were not the result of traction. They were demonstrated to a number of visitors, with the kidney in its normal position, without the least degree of torsion of the same (Fig. 11).

Pelvic mucous membrane smooth and shiny, except for a few punctate hemorrhages. Dilatation of pelvis extended into upper portion of ureter for a distance of nearly 4 cm.

The ureter showed an enlargement extending to about 4 cm. below kidney, resembling the bowl of a pipe, just distal to which was a peculiar twist in the ureter spiral, to the long axis of the ureter, so that when ureter was placed in the position occupied in the body there was an almost complete closure of ureter at this point, due to the spiral twist of nearly 180° and enlargement above it. There was a second spiral twist in the ureter, about 3 cm. below the one described above, and a tendency to a third a similar distance lower down. From this point toward the bladder, the ureter was quite large and showed no twists. The walls were thickened. Upon inserting a probe from the lower end of the ureter upward, one met with obstruction at the above-described twists, especially the one nearest to the renal pelvis.

Post-operative Notes.—The kidney wound healed without complications. The patient, however, continued to look very pale, although passing a large quantity of urine, which, microscopically, showed a considerable number of pus corpuscles and traces of albumin. The microscopic examination of the tissue of the left kidney showed a high grade of chronic diffuse nephritis, with small focal areas of polymorphonuclear leucocytes. Patient continued to feel well, being up and about, and shown in clinic a number of times. She was discharged from the hospital on October 15, apparently greatly improved, but returned on October 21, with symptoms of laryngeal stenosis and pulmonary oedema, due to uræmia, with resultant general anasarca, and died on October 25, 1911.

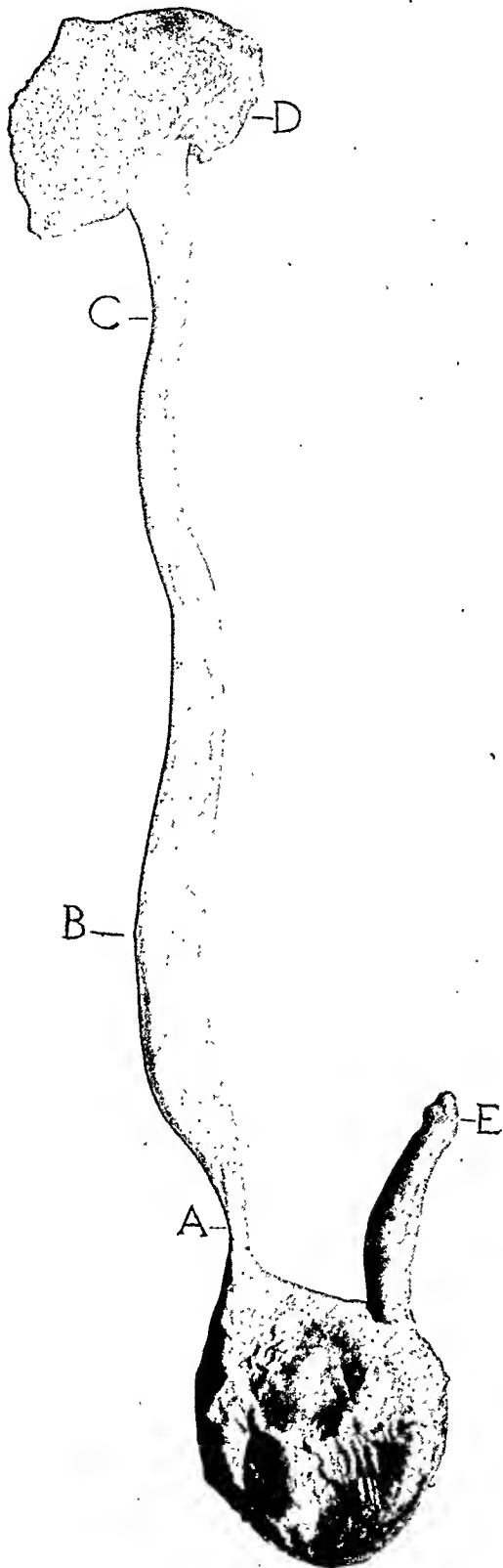
The autopsy showed an absence of the thyroid, thus confirming our clinical diagnosis of cretinism. I shall only add the report on the autopsy specimen of the right kidney, right ureter, and stump of the left ureter (Figs. 12 and 13).

The stump of the right ureter was two and a half inches long. From a point about one-quarter of an inch above its entrance into the bladder wall it became dilated. The convexity of the dilatation was toward the left; in other words, not symmetrical. The concave surface of the dilatation in this ureter faced the concave surface of the dilatation in the right ureter. The diameter of the dilated portion of this ureter at its widest point when filled with paraffin was almost one-half inch. Where it nar-

FIG. 14.



Case showing protrusion into bladder (Johnson's case). Right kidney enlarged and its pelvis distended. Right ureter dilated and curving. Double ureters on left side, both dilated and tortuous. Protrusion extends from left ureter into urethral canal (see text).



Congenital stenosis of the ureter (Case V). Note constrictions at A and C, and dilatation at B. E is stump of left ureter; D, right kidney.



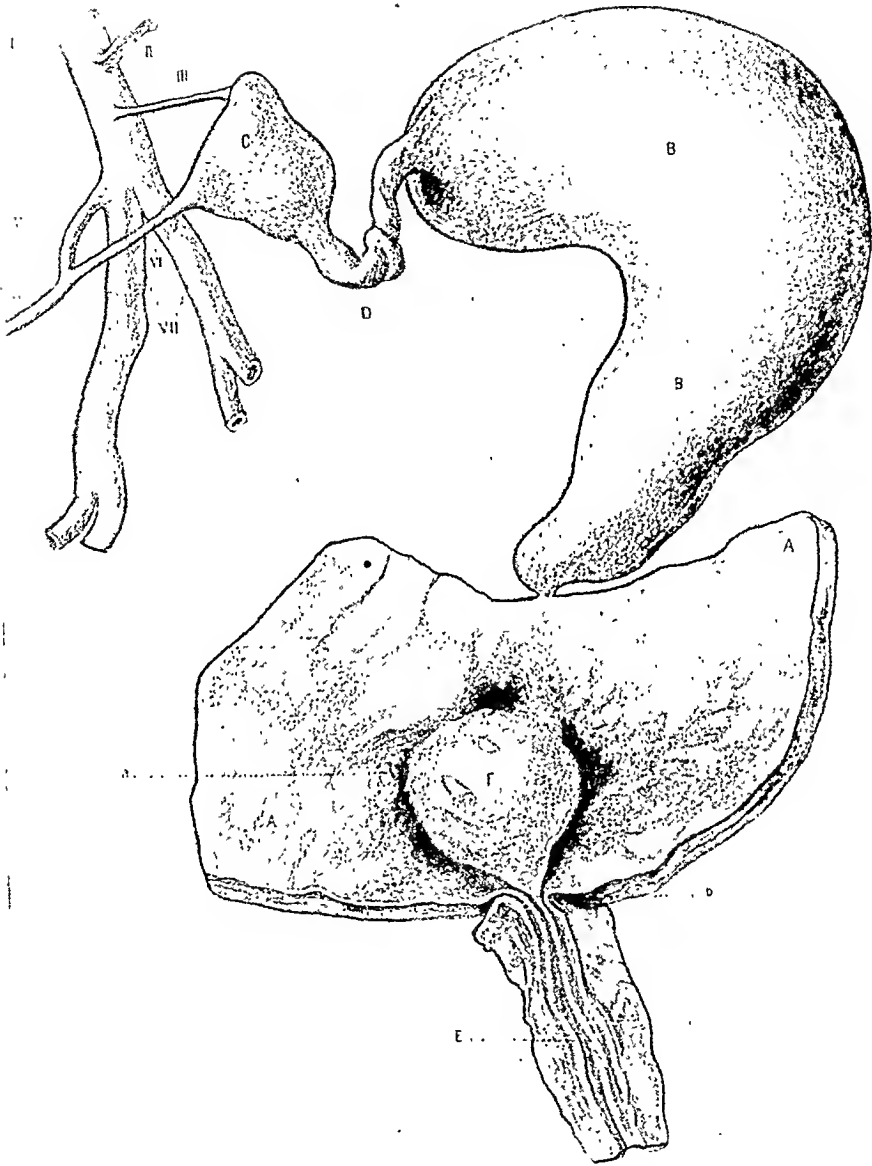
Right kidney, ureter and bladder (removed at autopsy of Case V). Bladder opened to show patent ureterostomy (left) and dilated right ureter and kidney.

FIG. 14.



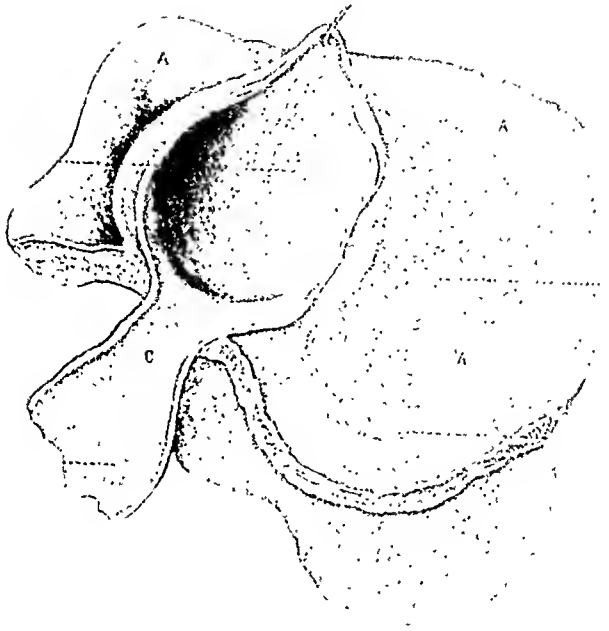
Case showing protrusion into bladder (Johnson's case). Right kidney enlarged and its pelvis distended. Right ureter dilated and curving. Double ureters on left side, both dilated and tortuous. Protrusion extends from left ureter into urethral canal (see text).

FIG. 15.



Congenital closure of left ureter, with protrusion of closed vesical end into bladder. Enormous dilatation of left ureter. Marked atrophy of left kidney. (Bostrom's case.)

FIG. 16.



Cystiform projection of right ureter into bladder. Ureter opens widely into protrusion.
(Bostrom's case.) (Type of Case V.)

rowed just before entrance into the bladder wall, it was one inch in diameter. The description of the vesical orifice of this ureter will be found under the description of the bladder. The right kidney was two and three-quarter inches long, one and one-half inches in width, and three-fourths inch in thickness.

The kidney showed no abnormalities in shape; the fetal lobulations were still quite marked. The true capsule was quite adherent, being almost impossible to strip. Distributed over the cortex of the kidney were a number of pin-point, yellowish areas, which upon section were seen to be small collections of pus. A similar condition was found at the operation of July 25, 1911, in the left kidney which had been removed. In addition to these yellowish areas, the surface of the kidney showed a number of pale yellowish elevations. The surface resembled that of a chronic interstitial nephritis. On section of the parenchyma, considerable purulent fluid escaped from the pelvis and dilated ureter. The cut surface of the kidney showed that the pelvis of the kidney was greatly dilated at the expense of the parenchyma. The calyces were markedly dilated and contained a turbid yellowish fluid. The pelvic mucous membrane lining these dilated calyces showed intense injection of the blood-vessels, and in places there was a considerable velvety appearance of the mucosa, *i.e.*, the typical picture of a chronic pyelitis. The parenchyma on section seemed to be present only to a small degree, maximum width being one-quarter inch. The parenchyma, wherever present, showed marked glomerular injection. The right ureter showed a marked constriction close to the point of entrance to the bladder. This narrow point corresponded to that on the left side, about one-quarter inch in diameter, and extended about one-half inch in a vertical direction.

From this point upward, for a distance of nearly four inches, occurred the first spindle-like dilatation of the ureter. The concavity of the spindle was toward the median line. Just above this point the ureter again narrowed and there was an incomplete spiral twist at this point. This was followed by a second spindle-like dilatation, which was shorter and ended about one and a half inches below the ureteropelvic junction. At this point there was a second less complete spiral twist.

Bladder specimen: Internal meatus readily admitted a No. 5 soft rubber catheter. The right ureteral orifice was distinctly visible, and showed no abnormalities and easily admitted ordinary probe. The left ureteral orifice corresponded to the point where the previous plastic operation had been performed. This readily admitted a No. 5 soft rubber catheter. Dissection of the bladder wall for traces of a previous distal pouch corresponding to the lower end of the cystiform protrusion of the ureter was negative. This was, in all probability, due to the fact that between the date of operation of the ureter and the date of dissection of the specimen (six months), cicatricial contraction of this segment had caused complete obliteration of its lumen. There were absolutely no traces of any other ureteral orifice, which confirmed the observation made at the first operation, that no left ureteral orifice could be found, the orifice being simply represented by a little dimple covered with mucous membrane. The bladder walls showed marked hypertrophy, as

though great difficulty had been encountered in evacuating the urine, due no doubt to obstruction of the internal meatus by the cystiform protrusion.

REVIEW OF LITERATURE.

In my previous article I expressed my indebtedness to Dr. John T. Bottomley for the painstaking manner in which he collected all of the cases published up to the date of appearance of his article upon "Congenital Strictures of the Ureter," published in the *ANNALS OF SURGERY*, November, 1910. In order to better understand the nature of these congenital lesions of the ureter, I shall briefly review some of the chief points of my first paper.

ETIOLOGY.—This is not quite clear, but is best explained as either the result of the persistence of fetal conditions or a retardation of development of structures destined to perform important functions.

Persistence of fetal conditions:

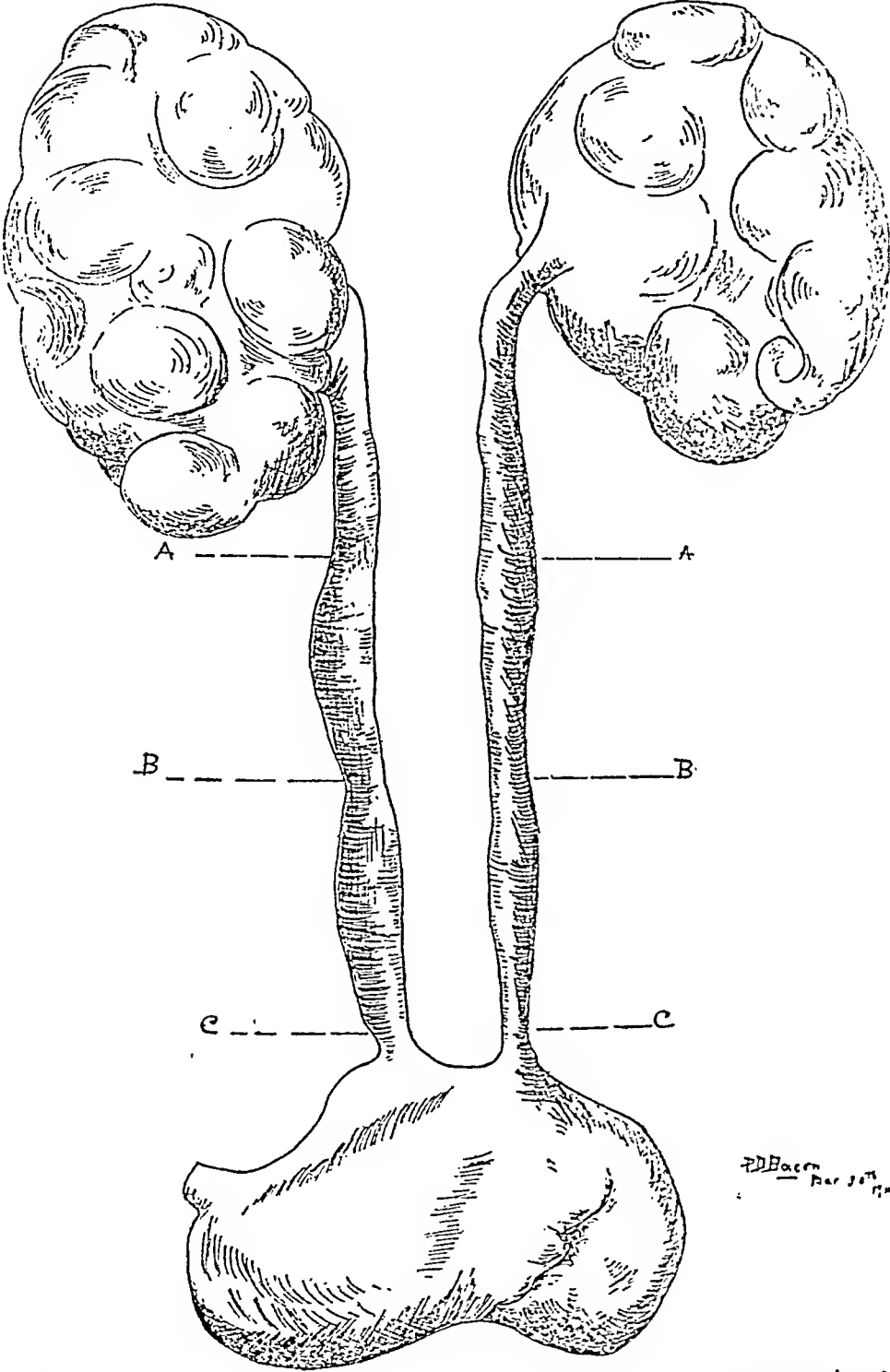
Seitz, Byron Robinson, Hamann, and others have shown by their studies of the normal ureter, in the foetus and at different periods of post-uterine life, that the ureter in all mammals possesses certain more or less constant points of narrowing and of dilatation. In addition, the occurrence of valves and of twists or tortuosities is not at all uncommon, especially in the fetal ureter. Figs. 17, 18, and 19 show where these various conditions most frequently occur. The points of narrowing are as follows:

1. Just before the ureter enters the bladder wall (*C* in Fig. 17).
2. Where the ureter crosses the pelvic brim (*B* in Fig. 17).
3. Close to the pelvis of the kidney (*A* in Fig. 17).

These three points of narrowing become more marked toward the end of fetal life, as Seitz has shown, and were constantly found in the normal adult ureter by Robinson.

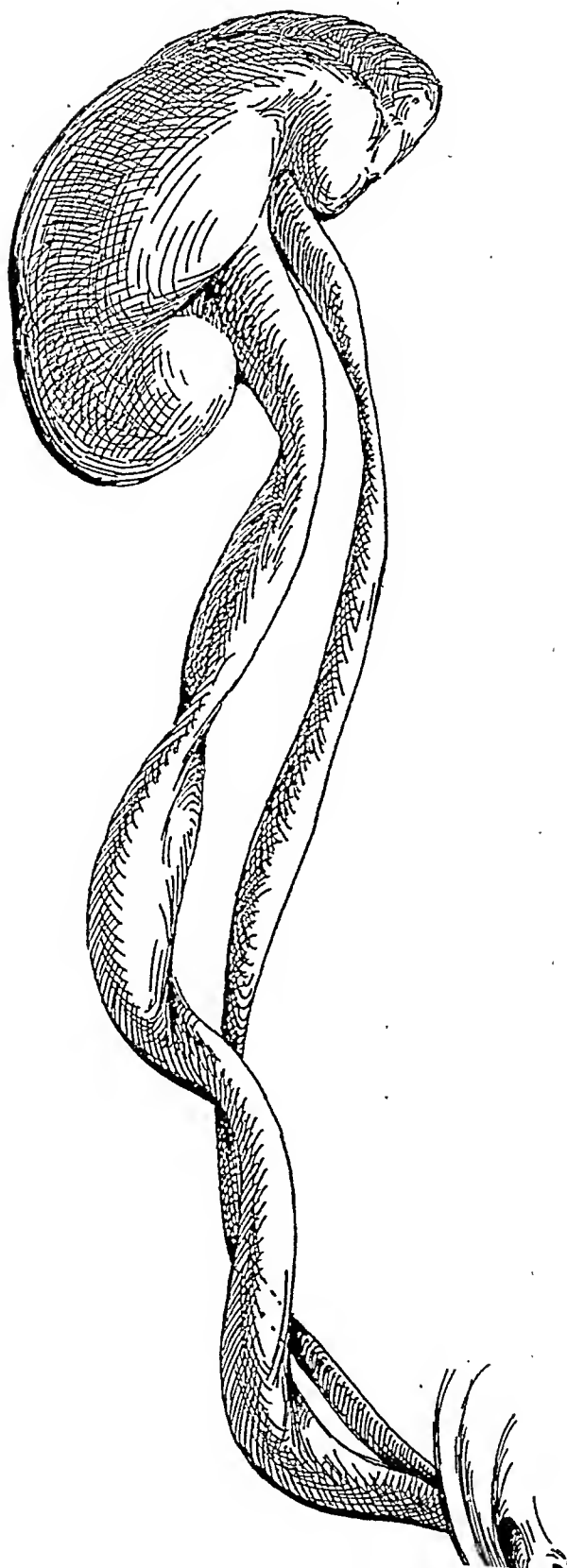
The dilatations are always found on the proximal side of these narrowings in the normal human foetus. The most marked widening is situated in the middle third of the ureter, *i.e.*, proximal to the narrowing which occurs at the pelvic brim or between it and the bladder wall.

FIG. 17.



Fetal ureters (Seitz) showing normal constrictions (A, B, and C) and normal dilations on their proximal side.

FIG. 18.



The spiral twists occur at any point, but are most marked at the junction of the upper and middle thirds of the ureter, as in the writer's case (Case V). The rôle which valves play in the production of stenoses is not quite clear. They are found in about 20 per cent. of cadavers of normal children, and contain mucous membrane, submucous and muscular tissue. In some cases the ureter is stenosed at the point where valves are found, and in all probability the valves play a rôle here.

CLINICAL IMPORTANCE.—The presence of the narrowings, twists, and valves, as found in the normal fetal and adult ureter, was formerly thought to be of interest to the anatomist and pathologist alone. Although a number of the cases collected by Bottomley were reports of specimens found at autopsy, yet in quite a large number the persistence of these congenital conditions gave rise to symptoms requiring operative measures. We shall see later that there are many cases which remain latent throughout life, and, on the other hand, quite a number in which infection or the presence of a tumor cause symptoms which draw the clinician's attention to the case.

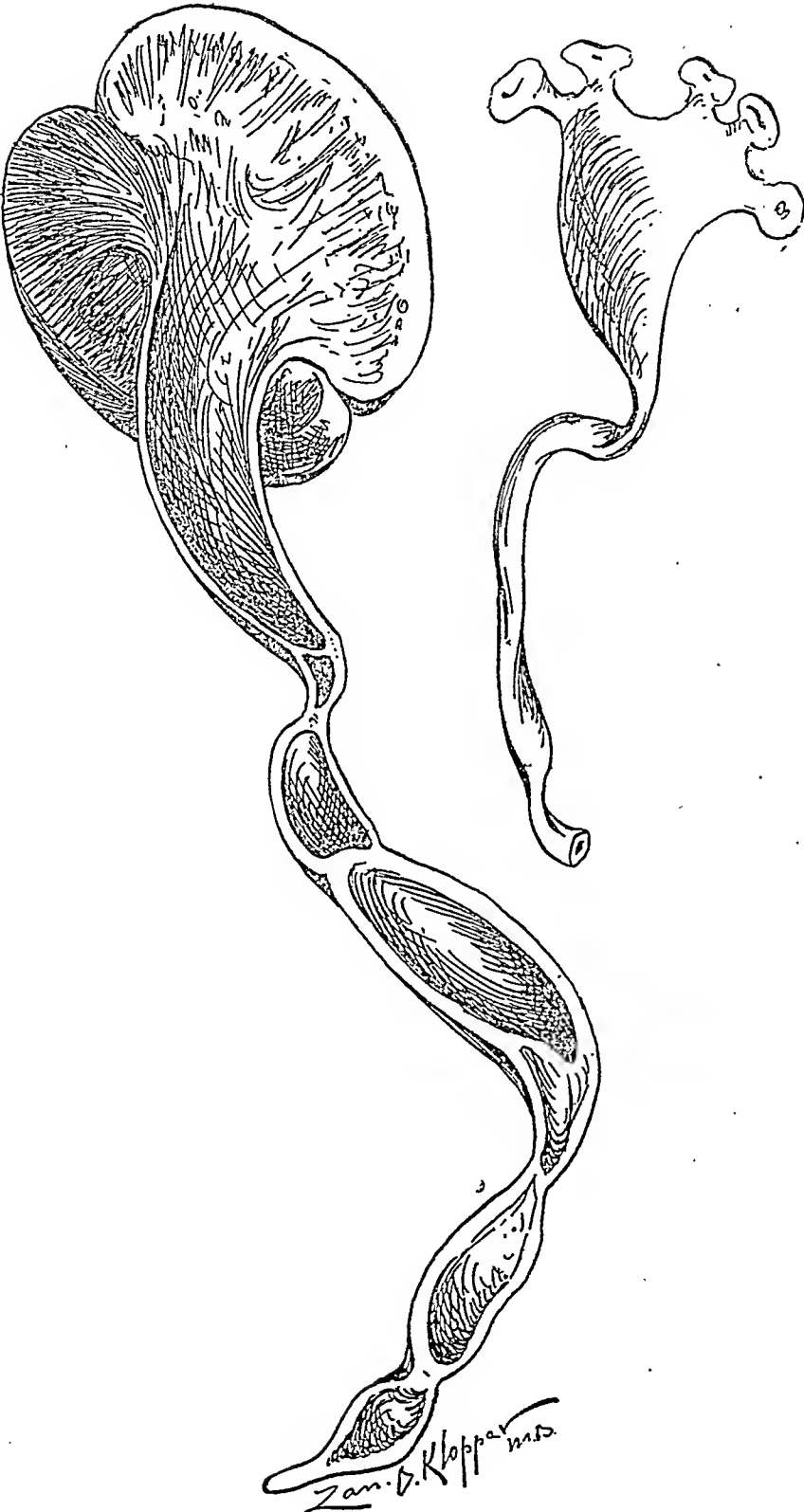
In several of the cases collected by Bottomley, a portion of the ureter was wholly fibrous, while in others the ureter was impermeable throughout and was represented only by a fibrous cord, a functionless ureter. Teyssèdre⁴ collected reports of eleven cases. Such a fibrous ureter may lead to absence of the kidney or of the whole or a portion of the ureter. In eight cases of Bottomley's series the stricture was located in the upper third of the ureter, usually at or close to the opening into the renal pelvis.

In 36 of 56 cases the obstruction was in or very close to the bladder; 17 of Bottomley's cases had vesical protrusions, 39 did not. Nichols's and Abt's (Fig. 8) cases showed a stricture both at the upper and at the lower end of the same ureter. The same ureter may present alternating portions with and without a lumen.

The most important, and, in their effects, the most far-

⁴Thèse de Paris, 1892.

FIG. 19.



Sagittal section of adult human ureter, showing spiral twists, constrictions, and valve formation (Byron Robinson).

reaching modifications of form are seen in the obstructions at the lower end of the ureter. In these the ureter usually reaches the bladder, but in most instances ends there in a blind sac. This blind end may be (a) just beneath the mucous lining of the bladder, (b) it may lie in the muscular layer of the bladder wall, or (c) may just reach the outer wall. If the blind end is in the muscular layer and one examines the bladder from within, there will either be no trace whatever of a ureteral opening, or in its place will be seen a dimple, a shallow invagination of the mucous membrane.

The most interesting forms, however, have to do with the ureters ending just beneath the vesical mucous membrane, as in my Case V. These produce a cyst-like protrusion of the mucous membrane into the vesical cavity. The protrusions range in size from that of a small pea to one completely filling the bladder lumen; the smaller are usually hemispherical in shape; the larger are either triangular or finger-shaped, sometimes reach the vesical opening of the urethra, may pass varying distances along the course of the latter, and in women may even appear at the external meatus. When empty, they are flat and flaccid; when full, they are finger-like, pear-shaped, and tense, broader and thicker at the base, gradually tapering and thinning in the direction of the tip. They vary in length from 0.5 cm. to 6.5 cm. The ureteral opening into these pouches may be bristle-like or may be an aperture 2 cm. in diameter. Usually (in 12 out of 17 cases) the protrusions are blind cul-de-sacs without an opening into the vesical cavity. In five cases there was a communication between the protrusion and the vesical cavity, almost invariably by minute openings at the tip or on the side of the former. The contents of the protrusions is usually a clear fluid. It may vary considerably in color. Sometimes it is muddy or cloudy.

Effect on Ureter.—When the obstruction is at the lower end, the ureter is almost invariably dilated, thin-walled, and tortuous. It varies in size from that of a pencil to that of the

small intestine (Fig. 7). It becomes widened and lengthened. Occasionally it is lobulated, shows windings and twistings (Figs. 11, 12, and 13), the latter also causing obstruction as in my fifth case.

Effects on the Renal Pelvis and Kidney.—Either an enormous hydronephrosis or a most marked primary atrophy may result from ureteral obstructions of the same location and character. Hydronephrosis of varying degree is the rule. It may show itself simply as a slight or a moderate distention of the pelvis, as in Case III, or it may present as an enormous cyst filling the whole abdominal cavity, with only remnants of the true kidney tissue in the cyst wall, as in Case II. Infection produces its usual disastrous effects, and in some cases completely disorganized kidneys are found.

Effects on the Bladder.—The cystiform protrusions of the blind ending ureter into the bladder may cause marked secondary pathologic changes in the bladder, as well as in the other ureter, or in the other kidney, as in Case V. The protrusion may block the opening of the opposite ureter. In other cases it may wholly obstruct the vesical opening of the urethra, give rise to a distended hypertrophied bladder, and then the usual sequelæ of retention of urine result. Both the right ureteral orifice and the internal meatus urethræ were blocked by the cystiform protrusion in Case V and the bladder walls greatly hypertrophied.

SYMPTOMS AND DIAGNOSIS.—In Bottomley's series, 19 cases gave either subjective or objective symptoms. Many cases occurred in subjects too young to make complaints. Hydronephrosis of great size and protrusions filling the bladder may exist for years without symptoms, unless infection occurs.

A survey of all the published cases of congenital anomalies of the ureter shows that clinically they belong to one of four classes: (1) Those in which the condition remains latent throughout life and is an accidental finding at autopsy. The majority of the published cases belong to this class. (2)

Those in which the presence of an abdominal tumor, which may or may not be diagnosed before operation as being of renal origin, is found when the abdomen is opened. My first and second cases belong to this class. In the first case the boy was thought to have an appendiceal abscess, on account of the persistence of the septic symptoms and the prominence of a tumor in the right hypochondrium, which was found at operation to be a hydronephrosis of the right half of a horseshoe kidney. My second case was diagnosed before operation as being a renal tumor, and in all probability a hydronephrosis. The probable congenital origin of the hydronephrosis was also diagnosed before operation, on account of the age of the patient—twelve years. The operation verified this diagnosis. (3) Cases in which the predominant symptoms are those of an abdominal infection. The clinical picture may resemble that of an acute infection of one of the intraperitoneal viscera, or it may point more directly to the kidney and ureter as the source of the symptoms of infection. My third case resembled a case of Bottomley's in presenting the picture of an intra-abdominal infection whose nature could not be accurately determined until operation. In my own case (Case III) the symptoms had begun very acutely, with pain and rigidity in the left half of the abdomen, and only under anesthesia was it possible to palpate what would seem to be rather a characteristic finding in these cases when it is present. This was also present in Bottomley's case. This is the palpation of a sausage-shaped tumor extending from the costal arch toward the pelvis and tapering somewhat from above downward. In cases where one suspects a dilated ureter and such a finding is present, one could easily confirm the diagnosis, if operative interference were not urgent, by filling the ureter with collargol solution and then taking an X-ray. (4) Those cases in which disturbances of micturition are the principal symptom. This consists either of increased frequency or retention. My fifth case belongs to this class. The principal symptom was a suprapubic enlargement, which was deter-

mined to be only in part due to a distended bladder. The catheterization in this case showed that there was still a tumor present, in spite of the evacuation of a considerable quantity of urine. In such a case or wherever there is a history of increased frequency of micturition in children, not due in all probability to any other cause, one should always bear in mind the possibility of a protrusion of the closed or almost closed lower end of the ureter into the bladder—what has been spoken of frequently in this article as a cystiform protrusion.

The examination of the urine is of little value, unless infection has supervened, and even then there is nothing specific to be found. In the second and fifth cases the urine contained a considerable number of pus corpuscles, without any active evidences of infection.

I have noticed one striking feature, and that is that these children who have congenital lesions of the ureter and kidney seem not to be as well developed as other children of the same age.

In no case thus far published, with the exception of my second case, was a diagnosis of congenital lesion of the ureter made before operation. I do not doubt, however, that since the attention of surgeons has been directed to these malformations of the ureters by the articles of Bottomley and the writer, that the condition will be more frequently recognized in the future. No doubt many cases will be recognized before operation, and at least the possibility of the presence of a congenital malformation be suspected, when a hydronephrosis is found in children. Cystoscopic examination will, of course, show the presence of cystiform protrusion, and it will be impossible in such cases to enter the ureter on the side of this protrusion, in many cases. When there is a ureteral opening present and the stenosis is higher up than the bladder, it may be possible in the future to distend the ureter with collargol and thus make a diagnosis from the radiographic examination.

TREATMENT.—The treatment depends, first, upon the degree of stenosis; second, upon the damage to the kidneys due

to the ureteral obstruction; and, third, upon whether infection is present or not. In the latter class of cases nephrectomy is, as a rule, the only method of treatment. If the kidney has not been too greatly damaged, it may be possible to perform a pyelo-ureteroplasty or implant the ureter into the bladder from a point above the stenosis. Some work has been recently done toward making artificial ureters, and I had intended in my second case to attempt the implantation of the Fallopian tube from a dog, in order to make an artificial ureter, but this was impossible, on account of the presence of pyelonephritis on the side of the stenosis. Cases have been operated on by Drew, Dudley Allen, Whipple, Mayo, Nichols, Bottomley, and myself. Of Drew's cases, one was cured and the other relieved by pyelo-ureteroplasty, the congenital stricture being near the pelvis in both cases. It was my intention to perform an operation of this kind in my fifth case, but the infected condition of the kidney and the complete twist in the ureter seemed insurmountable obstacles. In cases operated on by Dudley Allen and Whipple, nephrectomy was performed in both cases, successfully in Whipple's case, but in Allen's case a pyelonephritis developed and the patient succumbed. Mayo's, Nichols's, Bottomley's, and my first three cases are the only ones in which successful removal of both cause and effect by nephrectomy was accomplished. In my fifth case the patient seemed to recover from the ureterostomy, but nephrectomy was later necessary, on account of the infected condition of the kidney of the same side and the coincident twist of the ureter, shown in Fig. 11.

There are no records of any cases of operation in cystiform protrusion of the lower end of the ureter, and the ureterostomy performed in my fifth case is, so far as I can learn, the first report of an attempt to correct the protrusion of the lower end of the ureter in a congenital case. The autopsy in this case showed that the ureterostomy opening had remained patent and had it not been that the ureter was again obstructed by the twist close to the renal pelvis I have no doubt but that recovery would have been a permanent one. For the first

four weeks after operation the patient seemed to be in excellent condition. During the second four weeks the symptoms of infection due to pyelonephritis of the kidney of this side presented. Following her nephrectomy, two months after the ureterostomy, she had apparently made an excellent recovery until the uræmic symptoms suddenly appeared three months later.

CONCLUSIONS.

1. Congenital malformations of the ureters were formerly thought to be only of interest to the pathologist.

2. The surgical importance of these malformations is just beginning to be appreciated.

3. Four of my cases were found to give rise to clinical symptoms sufficient to require operation. The fifth case was a specimen obtained at autopsy.

4. The clinical picture in these cases varies. In some the abdominal tumor is the most prominent symptom. These are the cases which are generally spoken of as congenital hydro-nephrosis, where the obstruction is close to the renal pelvis. A second clinical variety is that in which the sausage-shaped tumor extends from the costal arch downward. A third variety is where a protrusion of the lower end of the uréter into the bladder exists. A fourth variety is where the clinical picture is that of a renal infection. Some of these cases may be very difficult to diagnose on account of their resemblance to other varieties of intra-abdominal infection.

5. The origin of all congenital malformations of the ureter is undoubtedly a persistence of fetal conditions. The principal varieties found at operation and autopsy are these: (1) no lumen for the entire length; (2) narrowing or localized absence of lumen at (*a*) ureteropelvic junction, (*b*) upper third alone, (*c*) both upper and lower thirds, (*d*) vesical end (cystiform protrusion); (3) spiral twists, usually one or more; (4) in none of the cases was the lesion due to any accessory renal vessels or any extra-ureteral inflammatory process.

OPERATION FOR ANEURISMAL VARIX OF THE POPLITEAL VESSELS.

BY JOHN CHALMERS DA COSTA, M.D.,

OF PHILADELPHIA,

Gross Professor of Surgery in Jefferson Medical College of Philadelphia.

Longitudinal incision of the popliteal vein. Suture of the opening into the artery from within the vein. Transverse division of the vein on each side of the opening with utilization of the isolated portion of the vein wall for a superimposed flap which was laid over the line of sutures in the artery. End-to-end union of the divided vein.

History.—Miss J., aged twenty-nine, white, native of New Jersey, was admitted to the Jefferson Hospital October 17, 1910. The previous July (something over three months before admission) the patient was accidentally shot. The weapon was a parlor rifle. The bullet, which was of No. 22 calibre, entered about the centre of the left popliteal space posteriorly and emerged anteriorly after passing through the head of the tibia. The knee-joint was not opened. The hemorrhage was moderately severe for a short time but soon ceased. The wound was dressed antiseptically and healed in a few days. A few hours after the accident the patient became conscious of a peculiar and annoying sensation in the popliteal space, which sensation has been continuously present ever since and has undergone a gradual increase. She describes it as a vibration or thrill that is like "feeling a roar." The thrill is and has been accompanied by marked pulsation, and both pulsation and thrill are growing more distinct every week. The patient has had no pain, although the leg has been and is weak. She has been wearing a rubber stocking because of swelling.

Examination on Entrance.—A small, depressed, white, irregularly circular scar is visible in the middle of the left popliteal space. A large and rather irregular cicatrix is noted below and to the outer side of the patella.

The leg and foot are a little swollen, somewhat œdematous, and decidedly pale when compared with the same parts of the

opposite extremity. The pulsation in the dorsalis pedis and the posterior tibial is very much weaker than in the corresponding vessels of the opposite side. The patient complains that the foot feels cold and it is distinctly colder to the examiner's touch than is the other foot.

The superficial veins of the leg and thigh are much enlarged and are tortuous but do not pulsate. The blood in the superficial veins flows in the normal direction. When the fingers are placed upon the surface over the popliteal space, a very distinct thrill is experienced. It is continuous and is characteristically the "purring thrill" described by Professor Matas and others. This thrill extends over an area from several inches above to several inches below the popliteal space, but is most marked over the middle of the space. It is most distinct at each cardiac systole. A murmur is heard on listening through a stethoscope. From the popliteal vessels a loud and continuous buzzing or purring murmur is heard, and this murmur becomes temporarily louder at each cardiac systole, that is to say, with each accentuation of the thrill. The stethoscope enables us to hear this murmur for several inches above the popliteal space and as low down as the ankle, but it is most marked over the popliteal vessels. When the thigh is raised to a vertical position, the thrill and murmur cease to be continuous and become appreciable only during cardiac systole. This observation accords with the observation made by Nélaton upon a case many years ago. Compression of the femoral artery in the thigh at once completely abolishes both thrill and murmur. There are no signs of trophic disturbance in the leg. The patient complains somewhat of aching, episodes of burning, and sensations of cold in the leg, and she walks stiffly and with difficulty. The pulse-rate is 70. Her general condition is excellent, and she is positive that the thrill is growing progressively worse. The condition is clearly one of arteriovenous aneurism.

[*Note to History.*—It is well known that a small percentage of cases of arteriovenous aneurism tend to spontaneous cure, but this event is too rare to be anticipated in any case, and it certainly is not to be anticipated when the signs of aneurism are growing worse instead of better. It is well recognized that many cases of arteriovenous aneurism last for years without causing grave danger or even serious annoyance. This statement, how-

ever, applies to the trouble when it arises in the neck and upper extremities, and is not accurate when we are speaking of the lower extremities.

In a lower extremity the lessening in the amount of arterial blood distributed to the parts below the aneurism and the increased impediment to the venous return produce sooner or later serious or even grave trouble from failing nutrition of the parts, and difficulties born of venous engorgement are almost certain to arise.

In view of the fact that in this patient an insufficient amount of arterial blood is being distributed to the periphery, that the veins are much engorged, and that the condition is not improving but is growing distinctly worse, it seems advisable to recommend an operation.]

Operation (October 22, 1910).—Five days after her admission and with the valued aid of my friend and colleague, Professor Francis D. Stewart, I operated upon Miss J. My intention was to open the vein by a longitudinal incision, suture the opening into the artery through the open vein, and then close the opening in the vein wall, but I was obliged to modify this plan by the developments during the operation. After etherization and with the patient supine, an Esmarch bandage was applied from the root of the toes to below the knee, at which point the band was applied and the bandage removed. After the extremity had been held for a time in a vertical position an Esmarch bandage was applied from above the knee well up upon the thigh, at which point the band was put in place and the bandage removed. The patient was then placed prone.

A longitudinal incision about six inches in length was made over the left popliteal space, and the vessels and the nerve were dissected free from the surrounding structures from above downward to the centre of the space. It was found that the vein and artery were directly fused somewhat below the centre of the space. There was no intervening sac. The artery distal to the point of fusion was small, but proximal to the same point was much dilated though not saccular. The vein distal to the point of fusion was very much dilated and much thickened. How far this thickening and dilatation extended could not be determined. The vein above the point of fusion was also enlarged and thickened. A longitudinal incision was made on the outer

side of the vein, the opening into the artery found and sutured. The suturing was effected by means of interrupted sutures of No. 0 iodized catgut passed vertically and like Lembert sutures. The longitudinal incision in the vein and the sutures passed about the opening in the artery are shown in Fig. 1.

On tying the sutures, it was found that so much of the vein wall had been drawn in by the stitches that the calibre of the vein was greatly lessened (Fig. 2). It was considered useless to attempt restoration of the vein by the method we had at first contemplated, therefore the vein was divided transversely on each side of the point of fusion to the artery, and this portion of vein wall was used as a flap and superimposed over the suture line in the artery and was sewed to the artery by catgut stitches (Figs. 3 and 4). Thus we used a flap of vein to strengthen the sutured artery at that point. The flap was about one inch in length. The two ends of the vein were then brought together. As the lower end of the vein was the larger, the upper end was invaginated into the lower end and fixed there by four catgut sutures. The junction was re-enforced by a few catgut sutures passed through the external coat of the vein at the line of junction. The tourniquets were removed and the blood jumped into both vessels. The blood in the vein was moving toward the body. The artery pulsated strongly and there was not a bit of leakage. Bleeding vessels in the popliteal space were caught and tied. The wound was closed by silkworm gut sutures and no drainage was employed. The knee was placed in a position of semi-flexion over pillows.

The patient made an uninterrupted recovery. A week after the operation the stitches were removed, and day by day the leg was straightened out a little. For a couple of weeks the leg swelled a little but never notably.

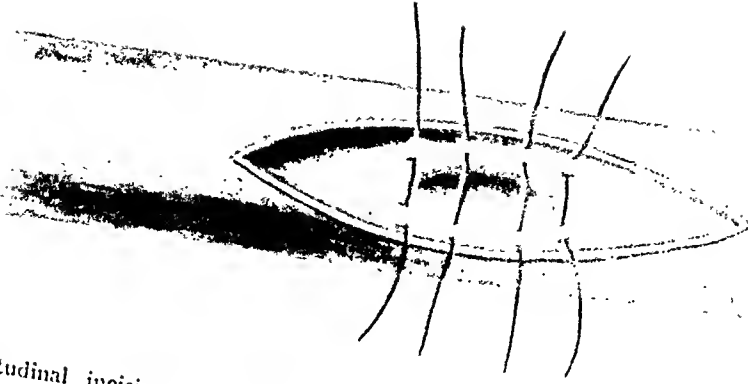
November 16: She was gotten up on crutches (a little over three weeks after operation).

November 24: She began to bear weight on the leg, still using crutches.

November 28: She left the hospital still using crutches as an aid.

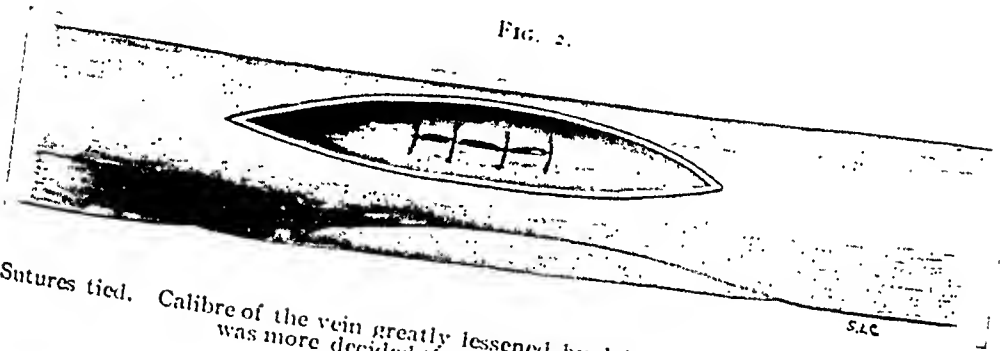
A month after this she put aside the crutches and walked naturally. At the present time (October 20, 1911), which is a year and one month after the operation, she is in excellent con-

FIG. 1.



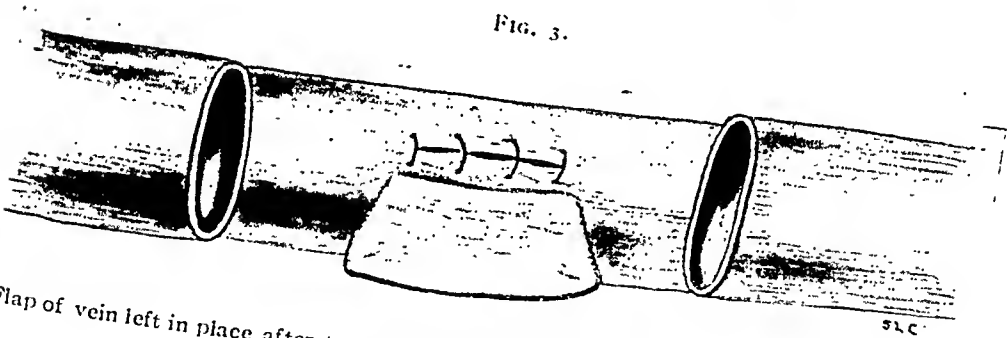
Longitudinal incision in the vein, and sutures passed through the margins of the arterial opening.

FIG. 2.



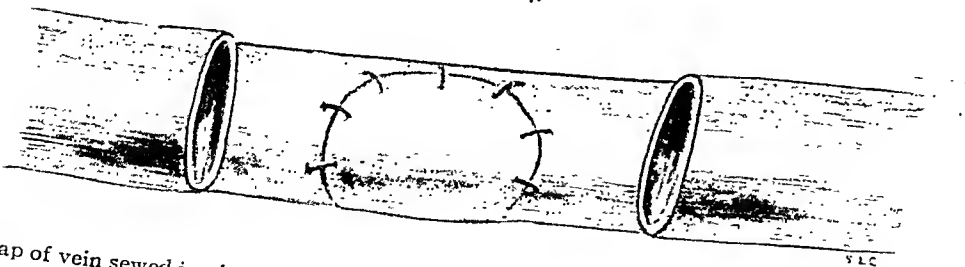
Sutures tied. Calibre of the vein greatly lessened by doing so (the diminution in calibre was more decided than is shown by the diagram).

FIG. 3.

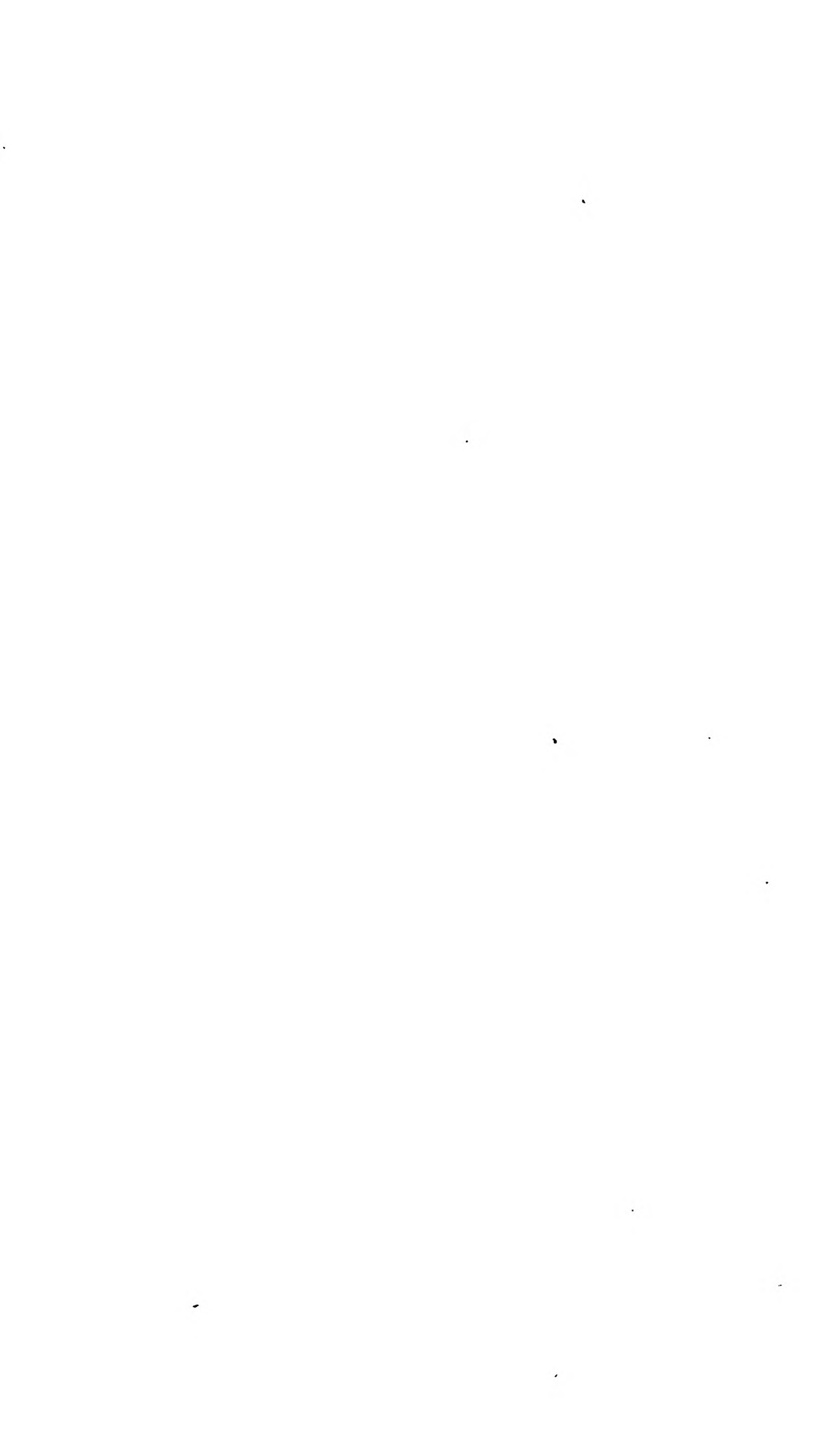


Flap of vein left in place after transverse division of the vein at two points (the flap was larger than is shown by the cut).

FIG. 4.



Flap of vein sewed in place upon the artery so as to cover in and reinforce the sutures in the wall of the artery.



dition, and walks easily and comfortably. The leg is free from swelling, pallor, and sense of coldness. The pulse in the dorsalis pedis and posterior tibial of the damaged side seems to be as good as the pulse in the corresponding vessels of the sound side. The superficial veins are much smaller though still visible. It would seem that it is justifiable to regard this case as a complete cure.

The interesting points about this case are the following:

1. That the symptoms appeared within a few hours of the accident. We know that symptoms may appear at once or in a very few hours, but as a rule they do not appear until weeks or even months have elapsed.
2. That although this was a gun-shot wound there was no intervening sac between artery and vein. The condition was an aneurismal varix and not a varicose aneurism. Of course a sac may have been present but have shrunk up and disappeared, although the fact that only three months had elapsed between the injury and the operation makes such an event improbable.
3. That it was necessary to destroy the vein in order to suture the artery. Perhaps this destruction could have been obviated if the sutures through the arterial opening had been passed in the direction of the long axis of the artery instead of vertically. In another case I would not pass them vertically, that is, I would not pass them at right angles to the long axis of the artery, but would insert them in the long axis.
4. That the destruction of the vein clinically added to the safety of the arterial suture by allowing the surgeon to reinforce the first suture line.
5. That the end-to-end union of the vein was apparently followed by immediate, complete, and permanent restitution of the blood current.
6. That iodized catgut sutures and intestinal needles were used for the vein and the artery.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held at the Mt. Sinai Hospital, January 10, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

CONGENITAL TERATOMA OF THE SUBMENTAL AND LEFT PAROTID REGIONS.

DR. ARPAD G. GERSTER presented a male, otherwise well-formed infant, seven days old, the fifth child of a healthy couple and the result of a normal birth. Immediately after delivery it was seen to be disfigured by a grotesque swelling occupying the submental and pretracheal region. The tumor, which had the size and shape of a large orange, was attached to the under side of the chin, sending out an extension up to the parotid, temporal, and mastoid regions of the left side. Its integument was shining from tension, and underlying it a number of large veins were visible. It was freely movable, and palpation gave evidence of an extremely uneven consistency. A large portion of it was evidently cystic, as proven by the withdrawal of about four ounces of a thin, dark bloody serum, the remaining mass consisting of tissue giving the feel of a lipoma, in which there were disseminated a number of irregularly ovoid bodies of the hardness of cartilage and a number of cord-like bodies. The trachea, larynx, and hyoid bone were not connected with the mass. Crying did not cause a more marked cyanosis than that observed in the face; there was no pulsation nor erectility. The mass was looked upon as a mixed tumor belonging to the class of teratomata formed in fetal life, possibly complicated by a branchial cyst of the left side. The presence of an enlarged thymus gland could not be demonstrated.

The bloody removal of such a large tumor at this tender age was out of the question on account of the intolerance of infants

to the loss of blood. Bloodless methods were also dangerous on account of probable sepsis. Moreover, the presence of a hygroma in the centre of the mass offered an additional warning against active measures, but the principal objection to these lay in the attacks of dyspnoea—laryngismus stridulus—to which the infant was subject. An elder brother of this child had succumbed to a similar attack.

SADDLE-SHAPED ULCER OF THE LESSER CURVATURE OF THE STOMACH, WITH HOUR-GLASS DEFORMITY.

DR. GERSTER presented a woman, 27 years old, who was admitted to the Mt. Sinai Hospital on November 20, 1911, complaining of dyspeptic symptoms complicated by sharp epigastric pain, which had set in about three years ago. The pains radiated to the back and the left shoulder and provoked two or three daily attacks of vomiting, the rejected matter being very acrid, containing mucus and sometimes fresh blood. After persisting for eighteen months these symptoms ceased for three months, then returned with renewed severity. There had been one copious hæmatemesis before admission.

When the patient came to the hospital she weighed only 68 pounds and was extremely feeble and anæmic. The blood showed 55 per cent. of hæmoglobin. The abdomen was scaphoid, and in the left hypochondrium an extremely tender, fixed mass could be felt. Posteriorly there was an equally tender spot in the tenth intercostal space. Otherwise, all the internal organs were healthy. The diagnosis of a perforating ulcer of the stomach was made, the perforation being protected by previous adhesions. The use of the stomach tube was refrained from, and a methodical treatment for gastric ulcer was instituted by means of the administration of an alkali in the form of bicarbonate of soda, and frequent small doses of morphine, together with the application of an ice-bag over the tender mass. Nothing but water was permitted to be taken by the mouth for a number of days, nutrition being maintained by enemata.

Up to December 6 there was a steady diminution of hæmoglobin to 46 per cent., but the irritative symptoms having then disappeared, nutrition by the mouth (Lenhartz diet) was begun, which resulted in a rise of the hæmoglobin modulus by December 13 to 62 per cent. Three days prior to this, after the adminis-

tration of a large dose of unmixed carbonate of bismuth, a radiograph was made to locate the ulcer rather than for any other purpose, the intention being to resect the ulcer. Up to this time, in fact until a laparotomy had disclosed the true status of affairs, no thought was given to the possibility of the presence of an hour-glass stomach. There were no rational symptoms to awaken suspicion, and the use of the stomach tube was purposely eschewed.

The radiographs showed an irregular, scanty deposit of bismuth carbonate near the lesser curvature, but gave no other intimation. On December 14, a laparotomy disclosed the presence of a typical hour-glass stomach. The left lobe of the liver was closely adherent to the lesser curvature along the latitude of the line which divided the fundus from the antrum pylori, and, welded together with the stomach wall, presented a dense, hard mass, corresponding to a saddle-shaped ulcer of the latter organ. At the site of this ulcer, the larger curvature was drawn up very close to the lesser, this tight constriction dividing the stomach into two uneven loculi: a larger one, consisting of the fundus, and a lesser one, representing the antrum pylori. The stoma connecting the two loculi was close to the lesser curvature, and barely permitted (by invaginating the anterior gastric wall) the entrance of the tip of the index-finger. Without disturbing the region of the ulcer—so well protected by the adhesions to the liver—a suture anastomosis was established between the two loculi of the stomach. Following this, food was withheld by the mouth for three days; then oral nutrition was begun with liquids, buttermilk, broth, orangeade, and diluted claret, and by December 19 with pea soup, cocoa, and milk-shake with egg. A constant hunger demanded great care against imprudences which the patient was ready to commit. By January 6, 1912, she had gained ten pounds in weight, and she is now gaining at the rate of one pound per day on a liberal and mixed diet. The radiographic plates, taken January 9, beautifully illustrated the distribution of the bismuth paste in the two gastric loculi, together with the new stoma established by operation.

DR. WILLIAM A. DOWNES said that about two and a half years ago he showed a patient at a meeting of this Society upon whom he had done a gastrogastrostomy for a condition very similar to that described by Dr. Gerster. In his case he had found the stomach adherent to the left lobe of the liver, and no attempt

was made to separate this attachment. Dr. Downes had operated upon the case two years before for acute perforating gastric ulcer, and she had remained well for one and a half years. This patient had suffered from periodical attacks of vomiting, with pain, and high acidity of the gastric contents, together with great loss of weight, which had since been regained. She is now perfectly well.

DR. HOWARD LILIENTHAL said that in one of his cases where the symptoms led him to believe that he had to deal with an hour-glass stomach, an operation failed to reveal that condition. In that case he did a gastro-enterostomy and cured the patient. The speaker said that in trying to recognize this condition, the Röntgenologists did not trust the skiagraphs, but depended upon fluoroscopy, watching the stomach while in action.

DR. CHARLES H. PECK said he had seen two cases of hour-glass stomach, one of which he had operated on last summer, four years after an operation for perforated gastric ulcer. In that case he did a gastrogastrostomy with very satisfactory results, the patient having no return of the symptoms. In a similar case, a year earlier, the operation of gastro-enterostomy in the proximal pouch was followed by very unsatisfactory results, as it gave the patient only temporary relief.

ARTIFICIAL INGUINAL HERNIA PRODUCED TO CAUSE EXEMPTION FROM MILITARY SERVICE.

DR. GERSTER presented a man, 43 years old, a baker and a native of Austrian Poland, who 23 years ago submitted to a procedure which, for the payment of fifty florins, resulted in the acquisition of a hernia. The *modus operandi* was as follows: The patient, at night and blindfolded, was taken to a strange address, where he was laid supine on the floor and was held there securely by confederates of the operator, who was a woman, probably a midwife. With increasing force she insinuated first one, then two and if possible three fingers into the inguinal canal, divulsing it as far as possible. This accomplished, the victim was permitted to rise and was given, sometimes a vomitive, but regularly an irritant and powerful snuff, to be used until a visible hernia was produced. The original fee was generally augmented by repeated exactions in the nature of blackmail, to which the patient submitted as an alternative to imprisonment.

In the case shown by Dr. Gerster, the hernia, originally a

bubonocoele, had within the last four months descended into the scrotum; it had formed numerous adhesions to the sac, had become irreducible and painful, and was the cause of frequent attacks of colicky pain.

On admission to the Mt. Sinai Hospital, on November 29, 1911, the left side of the scrotum presented a mass the size of a cocoanut, the contents of the sac being non-tympanitic, irreducible, and painful to the touch. The inguinal canal easily admitted the tips of three fingers. On December 5, 1911, a modified Bassini hernioplasty was done. Most of the large omentum was in the sac, the distal parts of which were firmly adherent to its bottom. There were also close adhesions to the peritoneal lining of the neck of the sac. These being liberated by dissection, the mass was withdrawn and spread out to permit the application of a series of ligatures in the manner of a lock-stitch, and the mass was then ablated with the actual cautery distally to this series of ligatures. The portion of the fundus of the sac adherent to the distal parts of the omentum was extirpated in one piece with as much of the sac as was not needed for the application of the purse-string suture by which the peritoneum was closed.

After the peritoneal stump was retracted, the epigastric vessels were seen freely traversing the hiatus, thus demonstrating the fact that a condition which united the characteristics of an oblique and of a direct hernia was being dealt with. Evidently, the transversalis fascia had borne the main brunt of the traumatism.

Better to secure the patient against a relapse, the conjoined tendon, together with the external oblique aponeurosis, were stitched as deeply down as possible on the inner aspect of Poupart's ligament; then the free, redundant edge of Poupart's ligament was lapped over the cord and was stitched again to the outer surface of the external oblique aponeurosis. Primary union ensued, and to-day the patient reported not only perfect comfort, but, as a gratifying by-product, the reappearance of his lost sexual potency.

DR. WILLIAM B. COLEY said that in an article on "Artificial and Traumatic Inguinal Hernia" (*Arch. f. klin. Chir.*, vol. xci, Hft. 3, 1910) Krymow pointed out that the former, which were produced by a special kind of "operators," were observed in

Russia only, and exclusively in persons who wished to evade military duty, mainly Hebrews, for, he added, the life of a Hebrew soldier was not an enviable one.

The question of artificial hernia had a three-fold significance: first, social and national; second, medicolegal; and, third, scientific, inasmuch as a study of the methods employed for the artificial production of a hernia might, at the same time, solve the question of the etiology of inguinal hernia.

Krymow described his experiments upon the cadaver for the production of artificial hernia, and stated that he succeeded in producing the same by tearing the aponeurosis and the transverse fascia. This might be easy or difficult, according to the size of the external ring and according to the strong or flabby condition of the fascia. A stout muscular layer might prevent the passage of a hernia, even though the fascia be torn. In the cadaver, a long-continued pressure was sufficient to produce a hernia. He reported five cases of his own, three of which were artificial and two traumatic, and on the basis of these, as well as other cases found in the literature, he divided traumatic inguinal hernia as well as the artificial into two categories: to the former (the majority) belonged such herniæ as were due to an injury above the external ring and in which the ring itself remained intact; to the second category belonged such cases in which the injury involved and destroyed the external ring. Artificial and traumatic herniæ that had developed after a rupture of the abdominal wall above the external ring could not be differentiated; the physical as well as the objective signs were the same.

Dr. Coley said he had seen a number of cases of artificial hernia at the Hospital for the Ruptured and Crippled.

Dr. PARKER SYMS said he had seen a number of cases of artificial hernia, and that he had reported some of them at one of the meetings of this Society. In the production of this form of hernia, he had been told that the administration of an emetic to cause violent vomiting was a part of the treatment.

COMPLETE EXTIRPATION OF THE COLON FOR PAPILLO-MATOUS DISEASE (TWELVE YEARS AFTER OPERATION).

Dr. HOWARD LILIENTHAL presented a patient whose case was originally reported by him in *American Medicine*, April, 1901. The patient was a girl, 21 years old, when she was referred to

the surgical department of Mt. Sinai Hospital by Dr. Morris Manges. She had for years suffered from diarrhoea, accompanied by hemorrhages and the passage of foul mucus, and she finally became so weak and anæmic that a left inguinal colostomy had to be done to give rest to the lower portion of the colon and rectum. The surgeon who opened the colon at that time saw that the walls of the viscus were covered with polypoid growths which bled easily even on gentle manipulation.

The patient was very much benefited by the operation, the hemorrhages finally ceasing, so that it was thought best to close the artificial opening. No sooner had she left the hospital, however, then her old trouble returned in all its severity, and she once more became profoundly anæmic and very weak. At this time, when Dr. Lilienthal first saw her, she had as many as twelve stools a day. There was much abdominal pain and some vomiting. The diarrhoea and bleeding were worse after the ingestion of certain articles of food, and she could not eat meat at all. On examining the abdomen, considerable tympanites was noted, but no distinct mass could be felt. Examination of the rectum disclosed the presence of several small polypoid masses. On account of the inability of the surgeon at the previous operation to reach the upper limits of the disease with the finger through the original colostomy wound, Dr. Lilienthal determined to open the caput coli through a wound in the right iliac region in order to give the entire colon as thorough functional rest as possible. This operation was done on December 30, 1899. He found the colon here in much the same condition that had been noted in the descending colon. There was no normal mucous membrane, the entire mucosa being covered by large and small papilloma-like excrescences. One of these was removed and submitted to Dr. F. S. Mandlebaum for pathological examination, and proved to be an hypertrophied solitary follicle. Incidentally, the vermiform appendix was removed at this time. Its mucosa was hyperplastic. Without going into the details of the treatment, the speaker said that everything which to his mind promised success was tried—nitrate of silver injections and irrigations, saline irrigations, etc. The patient's general condition rapidly improved. The hemorrhages ceased almost entirely, but it was evident that the closure of the right colostomy wound would surely be followed by the recurrence of her trouble, since the

condition of the visible mucous membrane was unchanged. He therefore made up his mind that the exclusion of the entire colon from the alimentary tract promised the greatest relief with the least degree of risk. Accordingly, on March 6, 1900, the operation of an end-to-end ileosigmoidostomy was performed. Through a median incision the ileum was sought out and divided about four inches from the ileocæcal valve. The intestine here was observed to be healthy. The lower end of the ileum, that adjoining the ileocæcal valve, was closed by invagination with the help of a purse-string suture of silk. The sigmoid flexure was then drawn into the wound, and was in turn divided somewhere in its lower half, its upper portion being also invaginated by means of a heavy purse-string suture. The lower portion of the sigmoid was then united by Murphy's button with the upper portion of the ileum, so that the intestinal contents would pass directly from the ileum into the lower half of the sigmoid flexure, which was comparatively healthy. A drainage wick was left in the lower angle of the wound, the remainder being closed by sutures. The right iliac colostomy was, of course, not disturbed, because it was understood that a vent for the secretions of the excluded portion would be necessary. Following this operation, the patient was kept quiet with opium. Full stimulation was necessary, as there was considerable shock. The urine on March 10 showed the presence of albumin and casts. The patient was then having numerous small, involuntary liquid stools. There was a large amount of exceedingly foul discharge from the right iliac wound, and it was necessary to wash out the excluded colon several times a day with a long rubber tube passed as far as possible into the lumen of the gut. On March 19 the Murphy button was extracted from the rectum with forceps. The patient's general condition at this time was greatly improved, although she still had ten or fifteen stools a day. On March 26 the number of stools had fallen to about nine per day. Dr. Lilienthal said that at this time he was surprised to learn that irrigation through the colostomy wound seemed to act as an enema, the patient insisting that the water injected through this wound was passed by the rectum. Irrigations with methylene blue showed that this was the case. At first he could scarcely believe such a thing possible, but afterward came to the conclusion that a tract of suppuration must have formed between the site of the

anastomosis and the invaginated end of the sigmoid. It certainly was an example of the wonderful way in which nature tried to re-establish normal conditions.

The patient now rapidly improved. The discharge from the colon became less and less, and the visible mucous membrane of the colon in the right iliac region had been cauterized, using the Paquelin cautery, with the hope of causing the formation of cicatricial tissue so that there would be no annoyance from the wet, everted mucous membrane. The patient insisted, however, that she would not be satisfied until the opening was closed. Knowing that the only way which promised success would be the total extirpation of the colon and stump of the ileum, Dr. Lilienthal hesitated to gratify her wish. Still, on considering the matter, he believed that this operation might, after all, be feasible, in view of the fact that the colon was already so to speak out of commission. Then, too, the mucous membrane had not atrophied, and still bled at the slightest touch, so that he was obliged to consider the probability that it would become the seat of malignant degeneration.

He therefore consented to operate once more, and on June 15, 1900, made a median incision at the site of the old scar. The first point sought out was the region of the anastomosis between the ileum and the sigmoid. He found here a fibrous cord, over an inch long, connecting the invaginated end of the sigmoid with the point of anastomosis. On dividing this, a central channel was found which explained the appearance of the methylene blue solution in the stools after its injection into the colon. This cord was cut off flush with the anastomosis, the place was inverted into the intestine, and the opening closed with a few Lembert sutures. The line of the button anastomosis was very perfect, and there was no induration. Beginning now at the sigmoid flexure, numerous ligatures were passed through the mesocolon, the extirpation coincidentally proceeding. The patient's condition became somewhat critical, and in order to save time he was obliged to take large masses in the grasp of each ligature. At a distance of about two and a half inches from the colostomy wound he cut off the colon and removed it from the abdomen. A long forceps was now inserted from without through the colostomy wound, and the end or stump of the colon was grasped and withdrawn, thus everting the stump. He then tried to treat

the stump of the ileum, which had shrunk to about two and a half inches, in a similar manner, but was unable entirely to evert it. With one hand in the abdomen he guarded against possible protrusion or prolapse of a loop of intestine into the funnel of the everted colon. At the same time he ligated with a piece of silk the entire everted stump, cutting away the external redundancy. The median incision was now closed by sutures, a gauze drain being left in its lower angle and another passed down to the right flank, where there had been some bleeding.

The patient reacted well after the operation, but on the following day she developed a pneumonia of the lower right side, which yielded to treatment. There must have been infection at this operation, for an abscess formed beneath the median wound through which foul-smelling pus and apparently fecal matter, but no gas, escaped. On the fourth day there was a distinct fecal discharge from the right iliac wound, the ligature having come away. Dr. Lilienthal could only account for the appearance of feces at this point by assuming the prolapse of a knuckle of intestine which was strangulated by the tightening of the ligature. On June 27 there occurred a spontaneous rupture of a large abscess at the site of the old colostomy wound, the evacuation of the pus being accompanied by the discharge of a piece of gangrenous mesocolon, with five or six chromicized catgut ligatures still in place upon it.

All the wounds finally healed with the exception of the fistula in the right side. Realizing that this would not close without another operation, he excised the entire cicatrix and fistula on October 6, expecting naturally to come upon the loop of small intestine which it was his intention to excise, anastomosing the ends. To his astonishment he found a single piece of intestine, not a loop, passing directly to the fistula. A large probe passed in at the fistula was seen traversing the lumen of this intestine. The intestines were matted together in many places, but it was possible to explore easily for fully ten inches along this gut without encountering adhesions. Knowing that the patient had passed but a very small portion of the daily quantity of feces through the fistula, he merely cut off this piece of intestine and invaginated it and then closed the wound by suturing, with drainage.

The subsequent course of the patient was most gratifying.

All the wounds were now closed, and at the present time, twelve years after the operation, the patient was in excellent general health. The stools, which were of normal consistency and form, were limited to one or two a day, the patient sometimes requiring mild laxation. An X-ray taken in January, 1912, by Dr. Jachcs disclosed a dilated condition of the stump of sigmoid which acted as an ample reservoir. The ileocolostomy was plainly visible.

LANE'S KINK OF THE ILEUM.

DR. LILIENTHAL presented a man, 25 years old, who was admitted to the Mt. Sinai Hospital on July 9, 1911, with the history that for the preceding year he had suffered from an intermittent pain in the right lower abdomen, with occasional vomiting. He also complained of hemorrhoids and constipation. The case was regarded as one of chronic appendicitis, and on July 10, 1911, the abdomen was opened and the appendix removed. Upon further exploration it was found that the right border of the omentum was attached along the entire border of the ascending colon and cæcum. The appendix had been found bent downward and backward beneath the caput coli; the base of the appendix, for a distance of about an inch, was of the usual size, but at that point it tapered into a slender cord-like structure to its extremity, a distance of about two inches.

About three inches from the ileocæcal valve the ileum was found sharply angulated by a distinct mesenteric fold, extending downward. This, as well as the omental attachment to the ascending colon, was divided, and the patient left the hospital on July 31. He returned on August 9 complaining of pain in the right iliac fossa, together with constipation. He was kept under observation, and on October 17, 1911, the abdomen was reopened, and upon exploration, firm adhesions were found at the ileocæcal junction. These were separated. The patient left the hospital on November 2, and had since remained free from symptoms.

LAMINECTOMY FOR EXTRAMEDULLARY TUMOR OF THE SPINAL CORD.

DR. CHARLES A. ELSBERG presented a woman from whom he had removed a glioma of the dorsal cord. When the patient was first seen she complained of nothing excepting pain on the

right side of the abdomen. She had been under treatment for a number of months for this pain, but without benefit. Careful examination showed that she had sensory and motor disturbances in the lower limbs, and that the pain was a root pain of the twelfth dorsal nerve-root. A large extramedullary tumor was removed by Dr. Elsberg after laminectomy and incision of the dura. The right twelfth dorsal root was found tightly stretched over the tumor. The patient made a good recovery, and was now perfectly well and free from all symptoms.

LAMINECTOMY FOR INFILTRATING TUMOR OF THE SPINAL CORD.

DR. ELSBERG presented a man from whom he had removed a tumor of the cauda equina. He gave a history of pain in the sacral region, with increasing loss of power in the lower extremities. He had the characteristic symptoms of absence of knee- and ankle-jerks, double drop-foot, reaction of degeneration in the peronei, and irregular sensory disturbances in the lower limbs. The tumor was a large endothelioma around the nerves of the cauda equina, and was removed in two stages.

Dr. Elsberg, in connection with these cases of spinal tumor, presented a number of specimens of tumors of the spinal cord which had been removed by him during the past two years. Four tumors were very large growths removed from around the nerves of the cauda equina, and the speaker made especial reference to the fact that the endotheliomata of the cauda equina presented a very characteristic clinical picture that should be recognized early. He also showed specimens of extra- and intramedullary growths of the spinal cord that he had removed by operation, and laid special stress upon the importance of the early recognition of spinal new growths. With early operation, the results should be excellent. He considered a laminectomy, done on a patient in good condition, as a not very dangerous operation.

DR. GEORGE WOOLSEY said he would like to hear from Dr. Elsberg how he had determined that the first case shown here about a year ago was an intramedullary tumor, for at the time he first showed it he was doubtful about it. Dr. Woolsey asked this because in two or three of the cases on which he had operated it was difficult to determine the origin of the tumor. The cord appeared enlarged and on incision several layers were divided

before the tumor was exposed, and it was difficult to say whether the tumor was derived from the pia arachnoid, was subpial, or perhaps intramedullary.

DR. ELSBERG, replying to Dr. Woolsey, said that after the dura was incised he found an enlarged cord surrounded by pia. After dividing the latter, the cord surface could be distinctly made out, and it was necessary to make an incision into it of at least 2 to 3 mm. in depth before reaching the tumor itself. The growth lay there, imbedded in the cord tissue and perfectly visible to the eye. In other cases, where the tumor sprang from the pia arachnoid and extended inward, the differential diagnosis between extra- and intramedullary growths was more difficult.

With regard to tumors of the cauda equina, Dr. Elsberg said he had reached the conclusion that they did not originate from the dura. In at least half of the cases he had seen, the cauda lay on top of the tumor. He was not prepared to say where these growths did originate.

RESECTION OF THE COMMON DUCT FOR CARCINOMA.

DR. ALEXIS V. MOSCHCOWITZ presented a woman, 48 years old, who was admitted to the medical service of the Mt. Sinai Hospital on November 5, 1911. For four months prior to that time she had been suffering from indefinite gastro-intestinal symptoms, chiefly characterized by pain which had its onset a few minutes after the ingestion of food and lasted for three or four hours. The pain was cramp-like in character and radiated backward to the spine.

Physical examination revealed a painful and tender mass in the region of the gall-bladder and a slightly enlarged liver. Upon admission to the hospital the patient was not jaundiced, but shortly afterward icterus appeared and rapidly increased in intensity, so that when she was transferred to the surgical side of the hospital, in the service of Dr. Gerster, she was of a deep, bronze color. For three days preceding the operation there were rigors, with high temperature.

Operation, November 26, 1911, by Dr. Moschcowitz: Upon opening the abdomen, a large, tense, acutely inflamed gall-bladder was found, containing over 300 calculi. In addition, there could be palpated in the fundus of the gall-bladder a nodule, about the size of a marble, the exact nature of which could not

be made out at the time. The liver was much enlarged, but otherwise was apparently normal. A cholecystectomy was decided upon, and as he was preparing the cystic duct for the purpose of deligation (with perfect exposure and without any undue trauma) he suddenly perforated into the exceedingly brittle common duct, which he found filled with tumor tissue.

Despite a strong disinclination to perform so formidable an operation upon a more than precarious patient, he was forced to proceed. After mobilizing the duodenum, he exposed the common duct up to the point where it entered the head of the pancreas, and divided it. Its proximal end was also divided through apparently healthy tissue, and lay just at the hepaticocystic junction. A T-tube drainage was established, one end of the transverse part of the "T" being inserted into the hepatic duct and the other into the distal part of the common duct. Because of tension, he was able to introduce only two chromicized catgut sutures to reconstruct the posterior part of the common duct, while the anterior section of the duct was reconstructed out of the hepatoduodenal ligament and duodenum. The fundus of the gall-bladder (including the nodule previously mentioned) and about one-half of the gall-bladder were now extirpated, and a tube was introduced into the cystic duct and fastened by purse-string sutures. The external incision was closed in the usual manner.

There was very little drainage through the tubes; not more than 15 c.c. on an average per day, but there was considerable drainage along the sides of the tubes. The patient's jaundice soon began to fade and disappeared entirely within ten days after the operation. There were no post-operative complications whatsoever. On the fifteenth day the tube in the cystic duct was removed, and ten days later the T-shaped tube was removed also. Bile was found in the fæces from the first day after the operation, the stools previously having been absolutely acholic, and while the fæces even at the present time were deficient in the bile content, they were fairly well colored. The patient continued to discharge large amounts of bile through the fistula, though it was gradually diminishing in quantity, and the proper course of procedure was now under consideration, providing the fistula did not close.

Dr. Moschcowitz said that from his knowledge of the case

he felt confident that he could do a hepaticoduodenostomy, provided he found, upon exposure, that there was no recurrence of the growth, which, as well as the nodule in the gall-bladder, were pronounced by Dr. Mandlebaum to be carcinoma.

DR. PARKER SYMS said he recently had a case of common-duct obstruction with a sinus, leading from this duct to the skin. This sinus had followed an operation for removal of a gangrenous gall-bladder with drainage of the duct. This sinus was composed of fibrous tissue, and an interesting point is that it was such a definitely formed structure that it could certainly have been used to make an anastomosis with the intestine. However, this procedure was not resorted to. A large stone was removed from the duodenal end of the common duct and the sinus was resected and closed.

DR. LILIENTHAL, discussing Dr. Moschcowitz's case of resection of the common duct, suggested the use of a rubber tube, with the expectation that a sinus would form and that the tube would then be extruded. He certainly thought it worth while to make a further attempt in this case.

DR. JOHN A. HARTWELL said that experiments of this kind had been done on dogs.

DR. GERSTER said that a similar procedure was employed by Dr. Brewer. He used a rubber tube which he surrounded with omentum.

Dr. Gerster said that of all the plans that had been suggested, he thought the one mentioned by Dr. Moschcowitz, namely, to join the hepatic duct direct to the small intestine, was the most feasible. This had been done successfully in France, and the procedure deserved more attention than it had hitherto received.

CHOLECYSTECTOMY, DUODENORRHAPHY AND GASTRO-ENTEROSTOMY FOR CHOLECYSTODUODENAL COMMUNICATION.

DR. MOSCHCOWITZ presented a woman, 40 years old, and a native of Austria, who was referred to him by Dr. Bernard Weiss on January 10, 1911. Twenty-two years ago she had had for the first time an attack of pain in the right hypochondrium. A year later she had a particularly severe attack, accompanied by jaundice of a few days' duration. Since that time there had been numerous attacks, particularly during her various (eight) pregnancies, but with the exception of the second attack already

mentioned, jaundice was not noted. For the past fifteen months the patient was ailing continuously, her chief complaint being pain in the right hypochondrium, radiating to the right shoulder. There was also loss of appetite, flesh, and strength.

Physical examination revealed the presence of a tumor about the size of a goose-egg, of stony hardness, occupying the region of the gall-bladder. There was also a small umbilical hernia, and the patient was three months pregnant.

Operation, January 12, 1911: An incision, four inches long, was made through the upper part of the right rectus. The gall-bladder, about the size of a goose-egg, was found imbedded in omentum, to which it was densely adherent, as well as to the descending portion of the duodenum. The adhesions were gradually separated, and a communication, about the size of a silver quarter, found between the gall-bladder and the descending portion of the duodenum. The literally stony hardness of the gall-bladder was caused by innumerable small and large calculi, tightly packed together into one solid mass. It was rather surprising that the gall-bladder did not evacuate itself in view of the large communication between the gall-bladder and duodenum.

After extirpation of the gall-bladder, the perforation in the duodenum was closed by an inverting chromicized catgut suture, reinforced by Lembert-Pagenstecher sutures. As this encroached too much upon the lumen of the duodenum, a posterior retro-colic gastro-enterostomy was rapidly done by means of a Murphy button.

The post-operative course was a rather stormy one. There was a slight pneumonic infiltration of the lower lobes of both lungs, which was probably the cause of some febrile reaction, but after the third day the temperature was practically normal. Of more importance was the uncontrollable vomiting which set in after the operation, and continued to such an extent that the patient was literally starving. Various factors were considered in connection with this vomiting, such as her pregnancy, the umbilical hernia, acidosis, etc., but none explained it fully and satisfactorily. Postural treatment and frequently repeated lavage ameliorated but did not entirely overcome the vomiting for some time. Gradually she began to regain her weight, which had fallen to 65 pounds, and she was discharged on February 2, 1911, with a small sinus which was discharging bile-stained fluid.

The patient was readmitted nine days later, having aborted in the meantime. No curettage was indicated, but the vomiting and a profuse biliary discharge again set in. These symptoms, under the conscientious care and nursing which she received in the ward, gradually abated, and she was finally discharged, on April 13, in very fair condition. At the present time she is in excellent health; in fact, she weighs more now than she ever did before in her life.

In connection with this case, Dr. Moschcowitz exhibited a series of X-ray plates, taken April 1, 1911. These showed a normal stomach outline, both as to size and shape, but in the middle of the greater curvature there appeared to be a break in the regularity of the outline, and part of the bismuth gruel was seen in the small intestine about five minutes after ingestion, showing an abnormal communication (gastro-enterostomy) between the stomach and small intestine.

GASTROMESENTERIC ILEUS FOLLOWING A CHOLECYSTECTOMY.

DR. MOSCHCOWITZ reported this case and showed the specimen, which was obtained from a woman, 34 years of age, who was operated upon by him on July 11, 1911, for a calculous empyema of the gall-bladder. The operation consisted of a cholecystectomy, which was unusually simple, the operation barely occupying 25 minutes. For three days she did perfectly well; there had been no untoward symptoms, and he practically considered her out of danger. Above all, he wished to emphasize that there had been no vomiting; nothing excepting the usual post-operative nausea which ceased a few hours after operation.

On July 14, three days after the operation, he was called to see the patient, who had gone into collapse, became cyanosed, with a rapid and thready pulse and distention of the abdomen. On searching for the cause of this condition, there appeared to him at the time only two possibilities: either a slipping of the ligature from the cystic artery, with secondary hemorrhage, or a slipping of the ligature from the cystic duct, with leakage of bile and the development of a fulminating peritonitis.

The patient was anesthetized and the wound reopened. Everything at the site of the operation was clean and in perfect condition. To the left of the incision there presented an enormous loop of intestine which it was at first difficult to recognize,

but which revealed itself to be the enormously distended duodenum. Soon thereafter the stomach came into view, distended so as to cover practically all of the intestines. A stomach tube was now inserted, and 76 ounces syphoned out. As a considerable part of the stomach contents was lost, Dr. Moschcowitz said he had no hesitancy in stating that the stomach and duodenum held at least 100 ounces. After this, the patient immediately began to improve; the pulse became stronger, and the cyanosis disappeared. The question of a gastro-enterostomy was considered, but the patient's condition did not warrant it; besides, it was not deemed necessary.

Subsequently, with appropriate postural treatment and lavage, the patient improved and her condition looked encouraging. On July 22, however, eight days after the second operation, she again went into collapse and died a few hours later.

A very thorough post-mortem examination revealed in the fresh state an enormously dilated stomach, its greater curvature hanging down to the symphysis, and the entire duodenum was similarly dilated. This dilatation ended abruptly at the point where the superior mesenteric artery crossed the duodenum, the artery standing out like a whip-cord. Below this point the small intestines were collapsed.

Dr. Moschcowitz said there had been much discussion recently as to what was the primary condition in these cases of gastro-mesenteric ileus, and he believed that this case went a long way toward proving the theory of compression of the duodenum by the superior mesenteric artery.

DR. JOHN A. HARTWELL said he did not think the case reported by Dr. Moschcowitz offered sufficiently strong evidence in proof of the fact that the dilatation of the stomach and upper duodenum was due to compression by the mesenteric artery. It was possible, he thought, that this constriction by the artery was secondary to the enormous dilatation and resulting gastroptosis.

In a case recently under his observation, Dr. Hartwell said, he accidentally produced a severe hemorrhage while ligating some of the arteries of the thyroid gland. In attempting to check the hemorrhage, the pneumogastric nerve was injured, resulting in acute dilatation of the stomach and death. At the autopsy, the stomach contents measured four litres, it was very much distended, and upon lifting it up, it was found that the

mesenteric artery had already produced a slight groove over the surface of the distended duodenum. In this case the dilatation had existed only a short time.

Dr. Hartwell believes the dilatation of the stomach to be primarily due to a paralysis of the musculature and the pressure on the duodenum by the mesentery to be a secondary result.

DR. HENRY H. M. LYLE said that in connection with the specimen shown by Dr. Moschcowitz he wished to refer to a case of acute dilatation of the stomach which was reported originally in the *New York Medical Journal* for November 4, 1911.

The patient was operated on by Dr. Lyle on July 21, 1908, for a large right inguinal hernia, the operation being done under local anæsthesia. The combined infiltration and intraneural method was employed, three-quarters of a grain of novocaine was used. The hernia had descended into the scrotum and contained a large amount of omentum. In order to reduce the hernia and guard against a future recurrence, it was decided to remove the redundant portion of the omentum. This was carefully done, causing the patient no discomfort. The mass removed weighed four pounds and two ounces. The hernia was repaired according to the Bassini method. The patient was returned to the ward in excellent condition. He was allowed some tea and toast, which is the routine for cases which have been operated on under local anæsthesia. About one hour later, the patient began to complain of pain and distention in the epigastric region. The usual carminatives, enemata, and stupes failed to give relief. The patient vomited a large quantity of brown, watery, colored fluid; this gave some temporary relief; then the distention began to increase rapidly. The lower border of the stomach seemed to be about three inches below the umbilicus. The patient became extremely restless, with a rapid running pulse of 135 to 150, and soon passed into a condition of partial collapse. Repeated stomach washings, combined with postural changes, gave temporary relief, large amounts of fluid and great volumes of gas escaping.

Eight hours after the initial attack, the lower border of stomach was thought to be in the right iliac fossa. Next morning the distention began to decrease, and all the acute symptoms disappeared within the following 48 hours. With the decrease of the distention, the patient's condition soon returned to the nor-

mal. He was discharged from the hospital four weeks later, and cautioned to remain under observation, as the hernia scar had been put to a very severe test.

Within a short time the hernia recurred. He was readmitted to the hospital and the hernia repaired under ether anæsthesia. The smooth recovery following this operation was in marked contrast to the stormy convalescence of the previous one.

This case shows a possible cause of acute dilatation. In all probability the removal of so large a portion of the omentum profoundly altered the circulation and possibly the nervous mechanism of the stomach, thus causing a temporary muscular paralysis. One cause that is sometimes given for this condition can be ruled out, viz., the toxic action of ether or chloroform on the stomach, and also the factor of rough handling of the intestines and stomach. The operation was done under local anæsthesia, and great care was taken to avoid all unnecessary handling and traction. There was no dragging on the omentum.

DR. MOSCHCOWITZ, in closing the discussion, said his patient did not vomit. In spite of the fact that the stomach held at least 100 ounces, there was no vomiting; it was the lack of this symptom which entirely misled him, and in consequence of which he had not the least inkling of the true condition.

Replying to Dr. Hartwell, the speaker said he was led to believe that the compression of the duodenum by the mesenteric artery was the chief factor of the dilatation in this case because the distention stopped sharply at the point where the artery crossed the gut. Beyond that the intestines were collapsed.

Stated Meeting, held at the New York Hospital, January 24, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

LINITIS PLASTICA: GASTRO-ENTEROSTOMY.

DR. ALEXANDER B. JOHNSON presented a case of linitis plastica in which the symptoms were relieved by a posterior gastro-enterostomy. The patient was a man, 35 years old, who had enjoyed good health until 18 months ago, when he began to suffer from severe epigastric pain, which usually came on about an hour after taking food and was relieved by vomiting. He

had never vomited blood, nor had any tarry stools been observed. During the past year he had lost 30 pounds in weight, and had grown weak and emaciated. Visible peristalsis was present for a week prior to his admission to the hospital.

Physical examination was practically negative, with the exception of some epigastric tenderness. A chemical examination of the gastric contents showed four ounces recovered from a fasting stomach, and 18 ounces after an Ewald test meal. The contents were negative for free hydrochloric acid, blood, and yeast.

After a posterior gastro-enterostomy the patient made an uneventful recovery, and left the hospital 22 days after the operation. Since then he had gained 22 pounds in weight and was able to eat practically anything.

DR. HENRY H. M. LYLE said that in the generalized form of linitis plastica, the stomach might be normal in size, dilated, or contracted; contraction was the rule, dilatation the exception. From Dr. Johnson's description and from the subsequent history of the case, it seemed probable that this was an instance of the dilated form.

The interesting point about these cases was the question of the correct surgical procedure. In his own case, Dr. Lyle said, he did a gastro-enterostomy but this was done in ignorance of the true nature of the condition. A study of the literature showed that it was practically impossible to make a diagnosis between this lesion and scirrhus cancer, so we were morally bound to perform a gastrectomy, providing the technical conditions were satisfactory.

DR. GEORGE WOOLSEY said that in one case similar to that shown by Dr. Johnson where he was called upon to operate he did a gastro-enterostomy, and the patient, apparently, regained his health. Within two years afterward, however, he died from carcinoma of the stomach. This corroborated the statement made by Dr. Lyle that in many of these cases we had to deal with some form of carcinoma.

CARCINOMA OF THE BREAST, WELL 22 YEARS AFTER FIRST OPERATION AND 13 YEARS AFTER LAST OPERATION.

DR. FRANK W. MURRAY presented a woman who first came under his observation on September 3, 1889, at St. Luke's Hospital. In the upper and outer quadrant of the left breast there

was then a tumor, about three inches in diameter, of stony hardness, nodular, and adherent to the overlying skin. It was non-adherent to the pectoral muscle. The axillary glands were apparently enlarged. On September 5, 1889, the breast was removed, together with the enlarged axillary glands, and two weeks later the patient was discharged from the hospital, with the wound healed.

On November 5, 1889, she was readmitted to St. Luke's Hospital. At the centre of the scar of the former operation there was a hard, tender lump, about the size of a horse-chestnut. This was removed through a wide, elliptical incision, and a week later the patient left the hospital with the wound healed.

The patient was not seen again until May 16, 1898. At that time there was a hard mass, about an inch and a half in diameter, in the left supraclavicular space, adherent to the trapezius muscle and the surrounding tissues. Through a four-inch incision along the anterior edge of the trapezius muscle, the mass of enlarged glands, together with a portion of the muscle, was removed. Twelve days later the patient left the hospital with the wound healed.

The patient was next seen in 1903, when she was apparently well, without any signs of recurrence. Since then she had been under Dr. Murray's personal observation, and at the present time, 22 years and 6 months after the original operation, she was apparently cured.

The pathological report of the original tumor of the breast was wanting. The report of the pathologist, however, on the lump removed at the time of the second operation showed it to be a typical carcinoma. The same was true of the mass removed at the third operation.

This patient, who was now in her eighty-first year, stated that she felt perfectly well, and as almost 13 years had elapsed since her last operation, it was quite possible that she was permanently cured.

DR. JOHNSON said he could not recall a case parallel to the one shown by Dr. Murray, where the patient had remained well for so long a period after the removal of the breast for carcinoma and in spite of a subsequent local recurrence above the clavicle. He had one case in mind where the patient remained well for 26 years, and then either had a recurrence or a car-

cinoma *de novo*—which it was he could not say. He, in common with others, had frequently been struck by the extraordinary difference in the degree of malignancy of tumors which appeared both macroscopically and microscopically to be identical. In a case of tumor of the breast which he removed about nine years ago he did not regard the growth as malignant, and simply removed the tumor without removing the breast. The pathologist reported that the growth was undoubtedly cancer, and still nine years had elapsed without signs of a recurrence.

Cases like the one shown by Dr. Murray, the speaker said, where the patients had remained free from recurrence after such long intervals, gave the surgeon new hope and encouragement in dealing with carcinoma of the breast.

DR. W. S. SCHLEY said that three years ago he operated on a woman 63 years old for a recurrent carcinoma of the breast which had been removed 13 years before. At that time both the breast and the axillary contents were removed, and the recurrence, which was about the size of a silver half dollar, occurred directly in the line of the scar, a purely local recurrence. Two years ago there was a second recurrence at the lower end of the old scar, and a year ago there was a third recurrence, also in the scar. This has progressed very slowly and has not yet been operated. The supraclavicular glands have apparently never been invaded.

During her earlier life, Dr. Schley said, this patient had been in very good physical condition and good circumstances, which perhaps had some influence upon the prevention of recurrences in carcinoma. In recent years she had been in poor circumstances, and, as a result, her health had suffered. The carcinoma had made its reappearance 13 years after operation, during the time of declining health and physical condition.

FOREIGN BODY IN ŒSOPHAGUS: ESCAPE INTO STOMACH AFTER INEFFECTUAL ŒSOPHAGOTOMY.

DR. FRANK W. MURRAY presented a man, 48 years old, who was seen early in the evening of February 12, 1911, some two hours after he had swallowed a gold plate to which were attached three artificial lower incisor teeth, the plate being fastened by bridge-work to the right canine tooth and the left incisor

tooth, respectively. The patient complained principally of pain low down in the neck, on the left side. There was no dyspnœa.

Upon introducing the index-finger into the pharynx, the foreign body could not be felt, and external palpation of the neck was equally negative. The patient was immediately sent to the New York Hospital, where an X-ray picture was taken, which showed the plate lying transversely in the œsophagus, at the level of the sixth cervical vertebra. With the patient's head in an over-distended position it was possible to grasp the plate between the jaws of a pair of long forceps, but all attempts at extraction were unsuccessful, as the plate was too firmly wedged in the œsophagus. An hour later, external œsophagotomy was done, and on introducing the index-finger through the incision in the œsophagus, the plate could not be felt. By means of a large bougie passed into the œsophagus through the wound, the foreign body was detected some three or four inches lower down, and from this point it was pushed into the stomach.

The œsophagus was closed with two layers of chromic gut sutures, and the wound in the neck was closed with the exception of its lower third, through which a small packing of sterile gauze led down to the œsophagus. For four days following the operation the patient was fed by means of nutrient enemata. A slight discharge from the wound appeared on the second day, which two days later became so copious that all sutures were removed and the wound was firmly packed with sterile gauze. The discharge continued to be very profuse for ten days, necessitating a frequent change of dressings, but when the patient left the hospital, 17 days after the operation, it had greatly diminished. Three weeks later the wound had entirely closed.

An X-ray picture, taken on the day following the operation, revealed the fact that the plate was still in the stomach, and a second picture, taken three days later, showed the plate in the cæcum. On the following day it was passed spontaneously. At the present time the patient was perfectly well, and experienced absolutely no difficulty in swallowing his food.

DR. ARTHUR C. VOSBURGH said that an interesting illustration of how large a foreign body could pass through the intestines had recently come under his observation. A man swallowed two silver half dollars. They were followed through the intestines with the X-ray, and were expelled spontaneously on the fourteenth day.

POSTERIOR CONGENITAL DISLOCATION OF THE LEFT SHOULDER.

DR. J. M. HITZROT presented a girl, eight years old. Three days after her birth her aunt noticed that she did not use the left arm as freely as the right. There was nothing abnormal about the birth, and no instruments were used. Since that time the child had used the hand freely, but was unable to raise it to her head.

Examination: The left arm was rotated inward. The elbow was forward with its point in front of the anterior plane of the body. The shoulder was flattened anteriorly and the acromion process prominent. Below and behind this prominence the head of the humerus could be seen and felt to rotate with the shaft. Abduction was limited to 45 degrees; external rotation to less than 10 degrees, and internal rotation to a still less extent. With a hand high in the axilla, the anterior surface of the glenoid could be palpated with the head of the bone behind it. The electrical reactions of the arm muscles were all normal, and no thickening could be felt in the region of the cervicobrachial plexus.

An X-ray negative showed a displacement of the head of the humerus, and a lack of growth of the neck of the scapula and the upper end of the humerus, as compared to the opposite side.

Operation December 12, 1911: An anterior incision was made over the shoulder-joint, and the deltoid and pectoral muscles separated. The deltoid was turned back as a flap by separating it from the clavicle and by cutting through a thin layer of the acromion with a chisel, and carrying this back with the muscle. The head was found rotated backward, the capsule small and stretched across the glenoid fossa. The subscapularis tendon was found at the lower level of the glenoid. The tendon of the long head of the biceps lay on the axillary side of the bone. The capsule was intact, and no tear could be found. It was so small and contracted that the head could not be reduced. The capsule was then freed from the humerus anteriorly. Thus the glenoid fossa was exposed and the head found resting on a facet on the posterior surface of that process, with the greater tuberosity close to the glenoid. The head was then freed by manipulation and replaced in contact with the glenoid fossa. After its replacement, it was found that the capsule was not large enough to cover the anterior surface of the head, and a flap from the

coracobrachialis tendon was used to cover in this defect. The deltoid was found to be too short, excepting when the arm was placed in abduction to the horizontal. The arm was placed in that position, and the severed acromion approximated by chromic gut sutures passed through drill-holes in that bone. The fascia, skin, etc., were closed with catgut, and the arm put up in moulded plaster splints in abduction to the horizontal. Convalescence was uneventful, and the result, now 43 days after the operation, showed the head in good position. The child could now place the hand on the head without difficulty when the splints, which it had not been considered wise to remove until seven weeks had elapsed, were removed for massage and passive motion.

ANTERIOR DISLOCATION OF THE LOWER END OF THE ULNA: LATE RESULT.

DR. JAMES M. HITZROT presented a girl, a nurse in training, who in September, 1910, had her right hand caught in a moving dumb-waiter. The radius and ulna were squeezed together and the hand forcibly supinated before she could withdraw it. On examination, the hand was found in flexion at the wrist, the lower ulnar prominence was absent, and there was a distinct fullness beneath the tendon of the palmaris longus at the wrist. There was no active motion; any attempt at passive movement was extremely painful, and the range of motion was limited to the barest possible movement. Reduction, under an anæsthetic, was accomplished by flexing the wrist in full supination and forced radial flexion. In the above position, firm pressure was made over the displaced lower end of the ulna, at the same time slowly extending the wrist, and the bone slipped back in place with a distinct snap. A photographic print of the X-ray was exhibited, which showed the anterior displacement of the lower end of the ulna and a fracture of the ulnar styloid. The result now, 15 months after the injury, was perfect function at the wrist, without pain.

BILATERAL CYSTIC KIDNEYS: SIX YEARS' OBSERVATION.

DR. HITZROT presented a man, 47 years old, who came under observation six years ago for vague symptoms referred to the abdomen. During the routine examination, an epigastric hernia and bilateral enlargement of the kidneys were discovered.

The patient was operated upon by Dr. Hitzrot at Bellevue Hospital for the hernia, and the peritoneal cavity opened to palpate the kidneys, etc. During the course of this examination the kidneys were found to be cystic, the left kidney being larger than the right. At the same time, a large gall-stone was felt in the gall-bladder, and this was removed through the ordinary incision used for that purpose. Since that time the patient had been examined repeatedly, and the kidneys had been slowly increasing in size. In November the patient complained of a small lump at the lower end of the former incision for the epigastric hernia, and a small hernia was found there for which he was operated on at the New York Hospital. During this operation, the peritoneum was opened and the kidneys examined and found to have increased to about three times their size at the former operation. The surface of the kidneys was also more irregular, and the cysts larger in size. No cysts could be felt on the surface of the liver. The urine had shown no regular features; at times it contained a little albumin, and varied in specific gravity from 1010 to 1030. At no time was any blood present. The man has no general symptoms at present, his only complaint being occasional pain in the loins after any unusual work.

Dr. Hitzrot, in answer to a question, said there was no evidence of involvement of the liver in this case. The liver was perfectly smooth.

GAS BACILLUS INFECTION.

DR. HITZROT presented a man, 27 years old, who was admitted to the New York Hospital in the service of Dr. A. B. Johnson, on August 31, 1911, with the history of having been run over by a truck, the front wheel of which passed over his left lower leg, inflicting a long, lacerated wound which extended from the knee almost to the ankle, and exposed the tibia at about the mid-portion of the wound. He was kept in the reception ward until the day following, at which time he had a temperature of 104°; the wound had a gangrenous appearance and a peculiar sweetish-fetid odor. There was very little discharge. On pressure, gaseous crepitation was felt at the upper angle of the wound and gas could be squeezed from the lacerated surface. Under ether, the wound was widely opened and two long cuts

made in the thigh reaching above the crepitation. Formalin solution (12.5 per cent.) was then poured into the wound and allowed to remain in contact with the tissues for ten minutes, when it was neutralized with peroxide and a wet dressing of peroxide applied. The leg was kept wet with this solution.

The culture showed the *Bacillus aërogenes capsulatus* (Welch), and the streptococcus.

Dr. Hitzrot said this was the second case of gas bacillus infection to recover by this treatment in his experience without amputation, in both of which the above mentioned organisms were present. The presence of the streptococcus in wounds infected by the aërogenes had seemingly increased the virulence of that organism.

DR. ROBERT T. MORRIS said that in one case of gas bacillus infection following a compound fracture of the radius in a boy, the process was kept under control as long as the entire limb was kept submerged in an antiseptic bath at body temperature. This was continued for some weeks, but an amputation at the shoulder finally became necessary because tissue repair would not progress in the bath. This was at the Post-Graduate Hospital. In another case upon which he operated at Mt. Vernon Hospital the infection also followed a compound fracture of the radius in a boy. In this case infection had extended to the pectoral region, but the patient finally recovered after a shoulder amputation, although the pectoral region was crackling with gas at the time of operation.

DR. LUCIUS W. HOTCHKISS said that his experience with cases of gas bacillus infection had led him to the conclusion that the degree and intensity of the infection depended not only upon the greater resisting power of the individual, but also upon the relative malignancy of the bacillus. Some years ago, at the Hood Wright Hospital, they had several cases of this infection, some following the subcutaneous injection of salt solution, which occasionally harbored these organisms. In those cases, the infection was relatively mild, and a simple wide incision sufficed. On the other hand, he could recall cases that were malignant from the start, and where general blood infection and death occurred very rapidly. He mentioned one case where the infection appeared on the passage of a sound five days after an external urethrotomy, and was rapidly generalized and fatal.

DR. HITZROT, in closing, said he thought the relative malignancy of the gas bacillus depended largely upon the presence or absence of the streptococcus. Those cases in which the latter was present in large numbers were the severe ones, in his experience. He had seen lacerated wounds in which the gas bacillus alone was present, which, except for their unhealthy appearance, caused no concern and produced no constitutional symptoms.

ANTERIOR DISLOCATION OF THE SEMILUNAR BONE.

DR. E. H. POOL presented a case of anterior dislocation of the semilunar in order to show the late results of the removal of that bone, the operation having been done in April, 1911. The patient was a teamster, 29 years old, who fell from a wagon two days before operation. The physical signs were typical, and the X-ray showed an absence of other lesion, such as fracture of the scaphoid. Reduction was impossible. The removal of the bone was accomplished without difficulty through an anterior incision, and the wound healed by primary union.

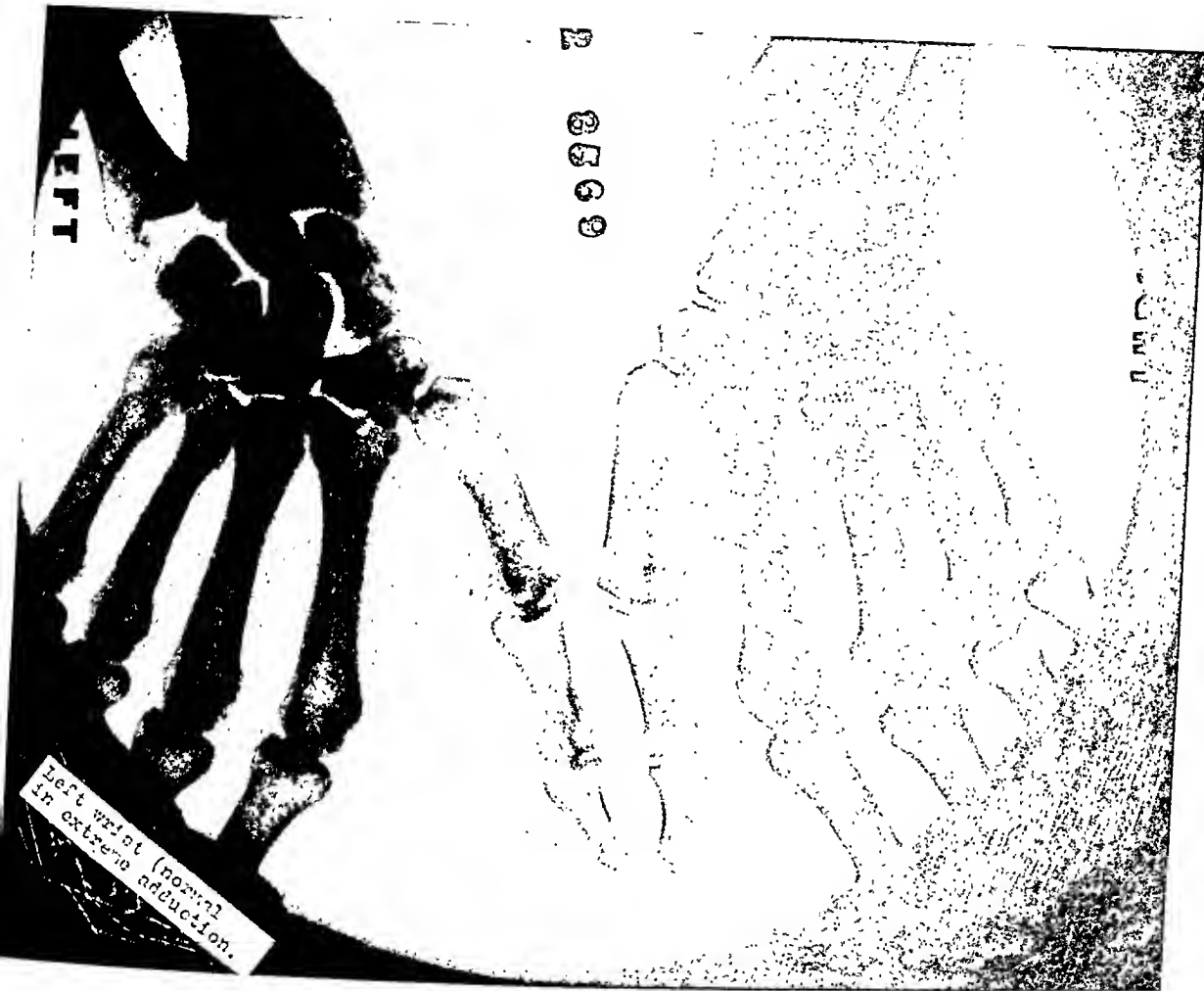
At the present time, the range of movements as well as the strength of the arm at the wrist were normal. All motions were painless excepting upon extreme adduction (ulnar flexion), which gave rise to pain immediately below the tip of the ulnar styloid. This was presumably due to the change in the relative positions of the carpal bones, whereby the cuneiform was brought closer to the tip of the ulnar styloid, against which it therefore impinged in extreme adduction. See X-ray. (Fig. 1.)

OLD SUBCORACOID DISLOCATION: OPERATIVE REDUCTION.

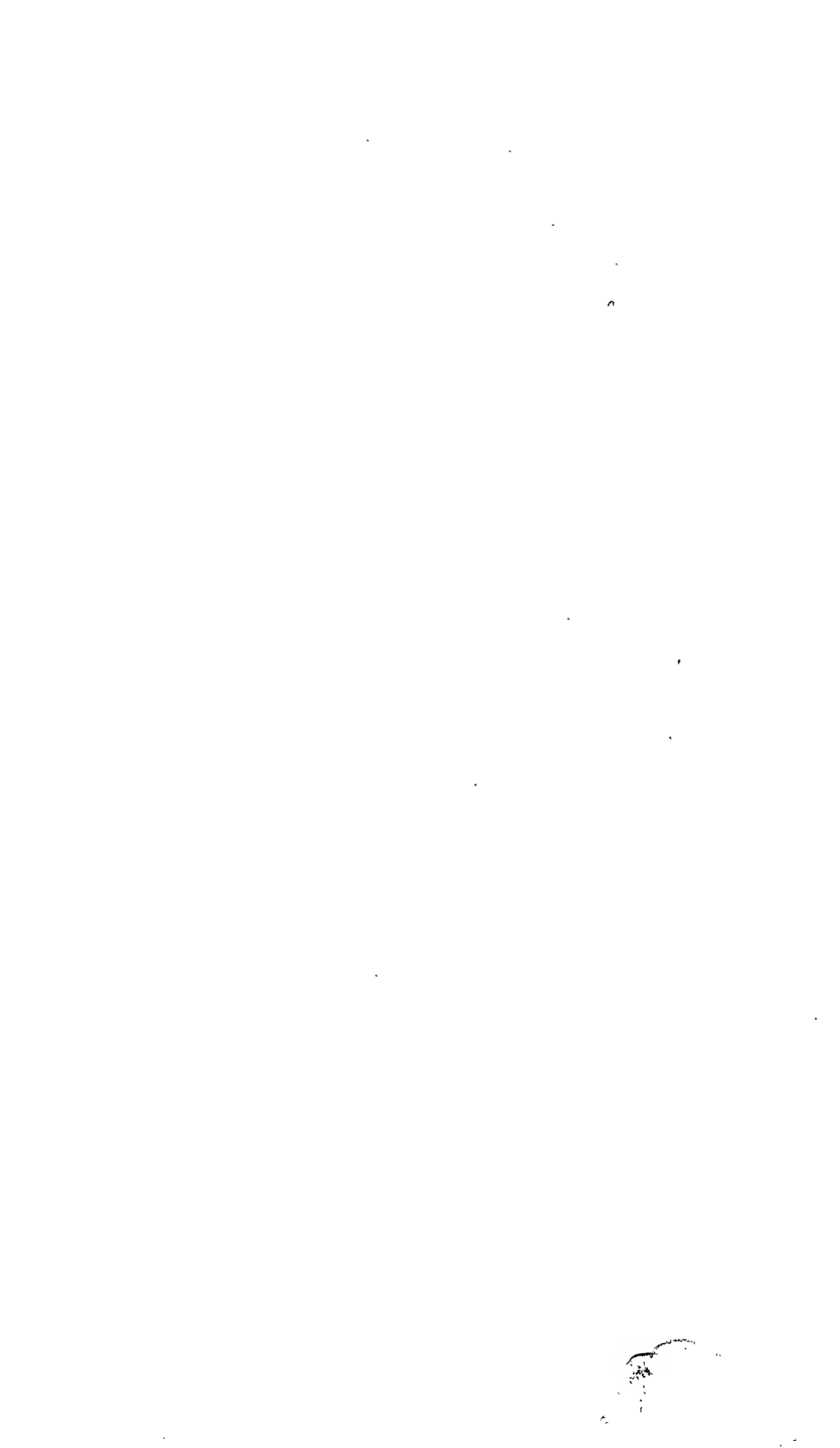
DR. POOL presented a woman, 41 years old, who on June 10, 1911, fell, injuring her right arm. When the patient was admitted to the House of Relief, four and a half months later, she complained of much pain in the arm. Examination and X-ray showed a subcoracoid dislocation of the humerus. Motion was very limited and the arm was weak. Efforts at reduction failed.

Operation: Through an anterior incision, the head of the bone was exposed. The biceps tendon was found to be displaced outward and backward, and was dissected free. The head could not be moved sufficiently for reduction until it was entirely freed from ligamentous attachments and the supra-

FIG. 1.



Anterior dislocation of the semilunar bone.



spinatus was cut. The posterior capsule was adherent to the glenoid and was excised, and the adventitious tissue removed from the glenoid cavity. After this, the head of the bone was readily returned to its normal position. The biceps tendon was sutured in its groove, and the anterior capsule was brought over the head as far as possible and its edges sutured to the deep surface of the deltoid, thus affording some protection for the head. Stab-wound drainage was established posteriorly, and the wound closed.

Healing was uneventful. Early massage and passive motion were instituted, and at the present time, three months after the operation, the head of the humerus was in its normal position, there was fair mobility independent of the scapula, showing that there was no ankylosis. With the aid of the scapula, the movements were much freer. Active motion showed 40 degrees of abduction without the aid of the scapula, and 90 degrees with it. There was rotation of about 20 degrees independent of the scapula; adduction was normal. The patient was able to place her hand on the top of her head, to the opposite posterior scapular line, and around to the small of the back. There was little or no atrophy, no shortening, and the strength of the arm was good.

This case, Dr. Pool said, raised the query whether in such a case the best functional result was to be obtained by replacing the head of the bone in its normal position, thus obtaining strength but limited motion, or by excising the head, thus obtaining greater freedom of motion at the expense of strength. It also suggested that the preservation of the anterior capsule as far as possible, and uniting its edge to the deep surface of the deltoid, was of advantage.

DR. L. W. HOTCHKISS said he had operated on a number of cases of old subcoracoid dislocation of the shoulder by arthrotomy with extremely satisfactory results, the functional results being very good. In a few cases, where he had resorted to excision of the head of the bone, the final results were also excellent. He preferred arthrotomy when practicable.

DR. JAMES M. HITZROT said that in a recent article by J. Dollinger in the *Ergeb. d. Clin. u. Orthop.*, vol. iii, 45 cases were reported, of which 39 were treated by the open method with very favorable results. In none of these was the dislocation older than one year. He also quoted the statistics of Schultze

and Küttner, who found that after arthrotomy in recent dislocations of the shoulder, only 13 per cent. to 15 per cent. gave normal function.

Dr. Hitzrot said that in the Out-door Department of the New York Hospital they had under observation at present two old unreduced dislocations of the shoulder which were being treated by massage. The patients had fairly good use of the arm, and an open operation was not deemed advisable because it did not seem likely to increase the usefulness of the arm, and other than the limitation of function, the patients suffered no discomfort.

Dr. WALTON MARTIN said that in two cases in which he had excised the head of the bone, the functional results were not as good as in the case shown by Dr. Pool.

PARTIAL GASTRECTOMY FOR CALLOUS ULCER NEAR PYLORUS.

Dr. POOL presented a man, 36 years old, who was admitted to the French Hospital on November 9, 1911, suffering from "indigestion and pain in the stomach." These symptoms dated back eight years; the pain radiated into the back and was relieved by the eructation of gas. He had been a heavy eater until four weeks before his admission, when his epigastric pain had become more constant and he had been able to eat but little on account of the exaggeration of the pain which he experienced for an hour or two after eating. He had vomited occasionally after taking food and suffered from chronic constipation. His weight on admission was 153 pounds.

An examination of the blood showed 4,500,000 red cells, with 74 per cent. of hæmoglobin. The stools were negative for blood. The stomach had a capacity of 1200 c.c. An examination of the stomach contents showed much mucus, with free acid 52, a faint trace of lactic acid, and a total acidity of 86; no blood. The X-ray pictures which were taken after the administration of bismuth were inconclusive.

Operation, November 16, 1911: The abdomen was opened through a high median incision, and an examination of the stomach disclosed a hardened area about one inch in diameter close to the pylorus on its posterior surface and lesser curvature. From this dense area the sensation of infiltration gradu-

ally faded. The entire pyloric region was covered by dense adhesions.

The impossibility of safely infolding or resecting the indurated area on account of adhesions to the pancreas, the danger of present or subsequent malignancy, and the advantage of an occluded pylorus with a gastrojejunostomy led Dr. Pool to decide upon resection. The pyloric end of the stomach was extensively resected, the lines of the incision sutured, and a posterior gastroenterostomy performed. No difficulties were encountered with the exception of the dissection of some dense adhesions to the pancreas.

The patient's post-operative course was uneventful, and he was discharged on the twenty-fourth day. His present weight was 183 pounds, and he was able to eat any kind of food.

The specimen showed a depressed ulcer on the posterior wall of the stomach, close to the pylorus. Its edges, which were raised, were as firm as cartilage, the induration gradually fading into the surrounding tissue. Many sections had been examined and showed no evidence of carcinoma. The induration was due largely to extensive thickening of the submucosa adjacent to the ulcer as the result of the formation of new connective tissue. The muscularis likewise presented extensive small, round-celled infiltration.

DR. GEORGE WOOLSEY said he thought Dr. Pool was entirely justified in removing a part of the stomach in the case he reported. The speaker said that in the last three of his own cases where he did a gastrectomy for callous ulcer of the pylorus, two of them, on microscopic examination, proved to be carcinomatous.

PARTIAL GASTRECTOMY FOR CARCINOMA.

DR. POOL said he showed this case on account of the persistent regurgitant post-operative vomiting, which cleared up under conservative treatment.

The patient was a woman, about 60 years old, who complained of pain in the epigastrium radiating to the left shoulder and left iliac region, and very sharp and severe in character. It was at first relieved by taking food, but later it became quite constant and more severe at night when she was in the prone position. There was no history of vomiting; the appetite was

poor; she was constipated and had lost about 20 pounds in weight during the previous three months. Palpation revealed a hard mass in the region of the greater curvature of the stomach, in and to the left of the median line.

Operation: On the anterior wall of the stomach near the greater curvature there was found a characteristic carcinoma. There were no enlarged lymph-nodes, excepting one near the tumor on greater curvature. A partial gastrectomy was done, and the lines of resection sutured. The stomach pouch was very small, and to complete the posterior gastrojejunostomy it was necessary to exert some traction on it. The anastomosis was difficult, as the parts to be sutured could not be brought to the surface of the wound. It was evident that the operation was defective in respect to the size of the stoma, and possibly as a result of kinking of the intestine by reason of the ascent of the stomach when traction upon it was released after completing the stoma.

There was persistent post-operative regurgitant vomiting, which began the day following the operation. Saline solution was administered per rectum, but it was not retained. Hypodermoclysis was thereupon substituted. Nutritive enemata were at first largely expelled, but were later retained. The vomitus was brown and fecal-like with an offensive odor. There were no indications of peritonitis, and the bowels moved readily after calomel. The obstruction was evidently not complete and it seemed likely that the operative defects would be adjusted and compensated for if the nutrition could be maintained and auto-intoxication prevented for a reasonable time. Lavage was begun on the third day. The patient continued to vomit from three to eight times daily, and regurgitated constantly. The stomach was washed out twice daily, and after each washing peptonized milk was introduced. Some fluid was found in the stomach at each washing. About the fourteenth day the vomitus changed to a dark green color; it gradually became lighter in color and less frequent, and ceased on the twentieth day. Lavage was continued for five weeks. The diet had been gradually increased, and the patient was now able to eat practically anything and was in good condition and free from pain.

Examination of the tissues showed carcinoma, including the adjacent node in the greater curvature.

CONGENITAL PYLORIC STENOSIS: GASTRO-ENTEROSTOMY
(TWO CASES).

DR. WILLIAM A. DOWNES presented a male infant, three weeks old, who was admitted to the Babies' Hospital on November 23, 1911, with the history of vomiting and constipation. It was the first child, born at full term and the birth was normal. The mother had had no miscarriages, and the family history was negative. The child had been breast fed up to the present time.

The history obtained was that the child had commenced vomiting twelve days before admission, when it was eleven days old. The vomiting, apparently, had no definite relation to feeding; it occurred sometimes immediately after feeding, sometimes one or two hours later, and was frequently forcible in character. The stools were green and slimy for several weeks prior to admission, and there was no movement of the bowels unless an "injection" was resorted to. The weight of the child on admission was six pounds, three and a half ounces; it had a fairly good color, but was considerably emaciated. A marked peristaltic wave was present, and a tumor the size of an English walnut could be palpated in the right hypochondrium.

A special diet was ordered, but in spite of this the vomiting persisted and the child became extremely prostrated and continued to lose weight. On November 27, four days after admission, an operation revealed a congenital hypertrophic stenosis of the pylorus, and a posterior gastro-enterostomy was done. Following this, the vomiting gradually grew less frequent and severe, and there was more substance in the stools. Since the child left the hospital, on December 19, it had vomited only twice, and the stools were those of a healthy nursing baby. Its present weight was over nine pounds.

Dr. Downes presented a second case in the person of a male infant, seven weeks old, who was admitted to the Babies' Hospital on December 7, 1911, with the complaint of vomiting and constipation of two weeks' duration. He was the fourth child, born at full term after a normal labor, and had been breast fed until two days before. The family history was negative; there was no history of miscarriages. The baby had apparently been healthy at birth and had gained in weight until two weeks ago. When it was five weeks old, the vomiting had suddenly set in; it was projectile in character and occurred after each feeding.

Constipation had been persistent, with rapid loss of weight. Upon admission to the hospital, the child weighed seven pounds, eleven and a half ounces. The vomiting persisted in spite of special diet, and on December 9 the abdomen was opened by Dr. Downes and a stenosis of the pylorus was found, similar to that in the first case. A posterior gastro-enterostomy was done. On the day after the operation, the temperature ranged between 100° and 103.4° , but on the fifth day became normal. The vomiting gradually became less severe, and seven days after the operation it ceased entirely. The stools became normal in appearance and the child was discharged on January 1, 1912. Since then there had been no vomiting; the baby was nursing well and gaining in weight.

Dr. Downes, in reply to a question as to the frequency of congenital pyloric stenosis, said that while he was unable to give the exact figures, the records of the Babies' Hospital showed that they had had about 35 cases in the past 6 years out of 5000 children admitted, not all proven, however, by operation or autopsy.

In both of his cases, Dr. Downes said, he did a posterior gastro-enterostomy without clamps, and in connection with this procedure he called attention to the importance of not making the opening in the intestine too large, as that interfered seriously with the anastomosis and unduly prolonged the operation. In order to avoid having the opening in the intestine larger than in the stomach, two guy stitches approximating the stomach wall and intestine were placed so that the first one, including the stomach and intestine walls, was held taut, while the second was passed through the stomach wall and the intestine, then put upon the stretch before the stitch was passed. In this way with care the two openings can be more nearly made of same size, and the difficulty in completing the suture due to redundancy of intestinal mucous membrane much lessened.

ŒSOPHAGEAL DIVERTICULUM: RESECTION OF ONE INCH OF CERVICAL ŒSOPHAGUS: END-TO-END SUTURE.

DR. DOWNES presented a woman, 34 years old, who was admitted to the New York Hospital on July 6, 1911. She gave a history of pneumonia nine years ago, but had otherwise enjoyed good health up to two and a half years ago, when she began to

regurgitate her food and experience increasing difficulty in swallowing. While talking, coughing, or laughing, mucus and food would suddenly "fly" out of her mouth. There was also increasing loss of weight.

An examination showed that an œsophageal bougie passed $8\frac{1}{2}$ inches from the teeth, and after the introduction of bismuth mixture, the X-ray showed a typical diverticulum situated at that point.

Operation, July 8, 1911: An incision was made along the anterior border of the left sternomastoid, from the angle of the jaw to the clavicle. The diverticulum was easily exposed and cut away after the application of a clamp. When this was done it was immediately noticed that the entire œsophagus had been divided with the exception of a strip about a quarter of an inch wide on the right lateral wall, and there was no alternative but to complete the division and bring the divided ends together with mattress sutures of chromic gut. This was accordingly done, and a catheter was inserted into œsophagus and left there. The wound was then partially closed, with drains down to the lower angle and the line of sutures. Feeding was carried on through the catheter. Considerable infection followed the operation, with burrowing abscesses which extended down behind the clavicle. These were emptied by the suction method.

The patient was able to sit up by July 20, and the catheter was removed three days later. The patient's further convalescence was slow and rather stormy, and she was discharged, cured, on October 12, 1911. She is now able to eat any and all kinds of food, has gained 20 pounds in weight. Ten days ago No. 34 bougie was passed with perfect ease.

The excuse offered for making what appeared at the outset to be a simple case into one of such serious nature is that too much reliance was placed upon the X-ray plates. Side view gave the impression that the opening in the diverticulum was quite narrow, and with this in mind, when the sac was exposed, even though the base seemed rather wide, a clamp was placed in such a way that it seemed that the wall of the œsophagus was not being encroached upon and that after excising the sac it would be an easy matter to close the opening with continuous sutures. However, it was immediately apparent that practically the entire œsophagus for one inch had been cut away. The

opening in the diverticulum had involved the anterior and posterior as well as left lateral walls. If he had properly exposed the cesophagus by raising it from its bed perhaps the extent of the opening would have been appreciated. And again the case would have been simplified had he made an opening into the diverticulum and explored before proceeding to excise it, but this was purposely avoided, hoping to prevent infection.

LARGE EMBRYONAL ADENOCARCINOMA OF THE KIDNEY: NEPHRECTOMY.

DR. DOWNES presented a woman, 34 years old, the mother of four children. When she was admitted to the hospital, on July 13, 1911, she gave a history of having suffered from asthma for the past ten years; otherwise, her health was excellent up to one year ago, when she began to suffer from pain in the right lower abdomen. After the birth of her last child, ten weeks ago, her physician noticed a well-defined swelling on the right side of the abdomen. This had gradually increased in size, and the pains had become more severe. The patient had begun to lose weight. There were no urinary symptoms excepting the passage of bloody urine on one occasion about three or four months ago.

Examination showed that the right side of the abdomen was occupied by a nodular tumor extending from well up under the ribs to the crest of the ilium. It was movable; not tender.

July 18, 1911, an exploratory incision was made through the right rectus by another surgeon, encountering a tumor which was so large that on account of the condition of the patient it was not deemed advisable to attempt its removal. After recovering from the effects of this operation, the patient was sent to the country for four weeks, and upon her return, the tumor was removed by Dr. Downes through a transverse incision, extending from the erector spinæ muscle to the outer margin of the rectus. The growth proved to be an enormous embryonal adenocarcinoma of the kidney. The patient made a rapid and uneventful convalescence.

LARGE HYPERNEPHROMA: NEPHRECTOMY.

DR. DOWNES presented a man, 46 years old, who was admitted to the House of Relief on March 16, 1911. He gave a history of having had typhoid fever sixteen years ago, but had

otherwise enjoyed good health until September, 1910, when he noticed that he passed small quantities of blood *per urethram* at intervals of two or three weeks. Shortly afterward, he felt a tumor in the left side of the abdomen, and about the same time he began to suffer from frequent micturition, especially at night. His general health was apparently not impaired.

Upon admission, an examination showed that the entire left upper quadrant of the abdomen was occupied by a smooth, solid growth. The urine contained many red blood-cells and a few pus-cells. The blood count was normal.

Operation, April 4, 1911: The abdomen was opened through a transverse incision, through which a large hypernephroma was removed. The patient made an uneventful recovery.

These two cases were shown by Dr. Downes in order to illustrate the value of the transverse incision for the removal of large tumors of the kidney.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held January 8, 1912.

The Vice-President, DR. GWILYM G. DAVIS, in the Chair.

TUMORS OF THE MALE BREAST.

DR. JOHN SPEESE read a paper with the above title, for which see page 530.

DR. JOHN H. GIBSON said that during the last ten years he had operated upon four cases of tumor in the male, a comparatively rare disease, and as these four cases present a variety of tumors he detailed their histories, as follows:

In 1903 at the Pennsylvania Hospital he had a patient, a man 21 years of age, a shoemaker, who said that in his work he was accustomed to putting the leather against his chest and cutting it. This man had had a tumor for one month, hard, and with glandular involvement in the axilla. The growth appeared at the time of operation to be malignant, and he therefore removed the breast, the pectoral fascia, and glands of the neck, but not the muscles. The pathological report was adenofibroma. The axillary glands were inflammatory.

In 1910, at the Jefferson Hospital, he operated upon an elderly man who had had a tumor for seven or eight years, undoubtedly carcinoma, and it was so reported by the laboratory. The growth had ulcerated and involved the nipple and an area around it. He made a complete excision and used the X-ray afterward.

In May, 1911, he had another patient, a man 66 years of age, who had a large tumor of the breast, movable, ulcerated, which had existed for a number of years and had been treated in London by a quack with caustic. This proved to be a spindle-celled sarcoma. This man had a number of tumors over the body, which appeared to be lipomata, and it was thought that

this tumor of the breast might have begun as a lipoma and undergone that rare change to sarcoma as a result of the irritation of the treatment received, but Dr. Longcope, who examined the specimen, did not agree in this, thinking the growth had begun as a sarcoma.

Dr. Gibson had another case in an adult, a physician 73 years of age, who had a hard tumor in the left breast which was quite pendulous, the tissues being very flabby; he was quite sure it was a malignant growth, though there was no glandular involvement. The man suffered at the time from a very bad cardiac disease, from which he died suddenly a few years later. He had had a number of attacks, and Dr. Stengel advised against the use of a general anæsthetic, and therefore the breast was removed under infiltration anæsthesia. The growth proved to be a fibro-adenoma of the diffuse type. There was no recurrence. He had operated on one case of tuberculosis in the breast in the male, the patient being admitted to the Jefferson Hospital with this diagnosis. The breast was amputated. This man had previously had both testicles removed for tuberculosis.

DR. EDWARD B. HODGE said the case of his mentioned by Dr. Speese was the only one he had operated on. It was interesting from several standpoints, one of which was the previous history of mastitis. This had been entirely forgotten by the patient. He had had several definite attacks of inflammation of the gland with discharge from the nipple, beginning at 15 years of age and reappearing at varying periods. He was 55 years of age when seen by Dr. Hodge. He had also been impressed by the great difficulty of covering in the space left after doing a complete operation on men because of the lack of adipose tissue over the breast.

DR. WILLIAM L. RODMAN agreed as to the rarity of benign neoplasms in the male breast. He had seen but two such cases, one of rather extensive fibro-adenoma, in a man about 35 years of age, which proved benign in character; another in a young boy who had been struck in the left breast with a base-ball. This patient was about twelve years of age and the appearance of the breast, especially the enlarged veins, was quite suggestive of sarcoma. A clinical diagnosis of probable sarcoma had been made, but after removal it turned out to be inflammatory. He had never seen a sarcoma in the male breast. He had, however, seen nine cases of carcinoma in the male breast, three of

these in negroes. The first case he ever saw was at the Jefferson Hospital in 1879 or 1880 in a negro. The point he wished to emphasize—one which had already been mentioned by Dr. Speese—is that the time at which carcinoma in the male breast appears is considerably later than in the female. Furthermore, he thought that trauma as an etiological factor is far more important in cancer of the male than it is in cancer of the female breast. In two of his cases seemingly a direct connection between trauma and the growth appeared certain. One was a shoemaker who was in the habit of resting his last against the left breast; the other was in a laborer who in using the shovel was in the habit of resting it on the breast in his work. Operations for cancer in the male breast should give a better result than similar conditions in the female.

SUTURE OF FRACTURE OF BOTH PATELLÆ, UNDER INFILTRATION ANÆSTHESIA.

DR. CHARLES F. NASSAU reported the history of a man, aged 65 years, who, on October 3, 1911, slipped on a muddy street and fell, sustaining transverse fractures of both patellæ. He was a man with advanced arteriosclerosis, and he had been for some time under the care of Dr. George DeSchweinitz who was treating him for a grave eye condition. The patient's blood-pressure was very high and he had albumin in his urine. He was an extremely intelligent man who readily grasped the danger of a general anæsthetic. His consent and co-operation were obtained to operate under infiltration anæsthesia.

Operation was on October 9, 1911: The infiltrating solution was made by dissolving one tablet in 50 c.c., and one tablet in 100 c.c. of normal salt solution. Each tablet contained cocaine, gr. $\frac{3}{4}$, adrenalin, gr. $\frac{1}{400}$.

A skin flap was raised in exposing each patella. The right patella was drilled and sutured with very heavy silver wire. On the left side a heavy braided silk suture was placed around the fragments without drilling. Both wounds closed without drain. Silver leaf dressing.

The post-operative course was uneventful. Healing perfect. At this date, 12 weeks after operation, the patient writes that he can walk 8 to 10 blocks daily without pain or fatigue. There is a full range of motion in both knees.

DR. JOHN H. JOPSON said that while he had not wired any patellæ under local anæsthesia, yet in one patient he sutured the quadriceps tendon to the patella, it having been torn from the bone. This old lady had advanced cardiac disease, she could not lie down, and suffered from more or less continuous dyspnœa, so that he did not dare give a general anæsthetic and used local anæsthesia, opening the joint during the operation practically as freely and widely as did Dr. Nassau. The patient made a rapid and complete recovery, however, without any infection of the wound.

DR. GEORGE G. ROSS said that local anæsthesia is a method often condemned because the man who is using it does not know how to use it correctly. He had used it in many instances, such as in the removal of bunions, whitlows, and minor surgery, with satisfactory results except in two instances. One of these was a healthy young woman with a lipoma of the shoulder; she was very much afraid of ether and he consented to operate under a local anæsthetic. She had a violent convulsion. Another case was a man 58 years of age with a large bunion. He injected the area with a 1 per cent. solution of cocaine, using, he should estimate, between 25 and 30 drops by the infiltration method. The man inside of two minutes had a violent convulsion. He finally made a good recovery though he was mentally disturbed for twenty-four hours. In these two cases the results might have been due either to the strength of the solution or to the idiosyncrasy of the patients.

The speaker had had experience with quinine solution in six cases. One was an amputation of the toe, the other five were circumcisions. He concluded not to try it again owing to the extremely bad results obtained; the wounds sloughed over a long period of time and behaved very badly.

DR. CHARLES F. NASSAU (in closing) said that one should avoid the use of strong solutions of cocaine. A 1 per cent. solution of cocaine is strong enough under any circumstances. Too strong solutions, and also the use of tablets picked up indiscriminately from a table in the operating room which may have been handled by nurses, are more often the sources of infection than any inherent qualities in the tablets. The tablets he used are sterilized in little vials by dry heat, and he had never seen any wound where he had used them become infected.

OPERATION FOR ANEURISMAL VARIX OF THE
POPLITEAL VESSELS.

DR. J. CHALMERS DACOSTA read a paper with the above title, for which see page 593.

DR. G. G. DAVIS said that this case was somewhat similar to one which came under his notice not long ago. The patient was a child 7 years of age, who, when about 3 years old was being circumcised. From some movement of the child the knife, which was lying on the abdomen, penetrated the thigh and wounded the femoral artery; a surgeon was called in and he ligated the femoral artery. About four years passed when the case came under his notice; it illustrates very clearly the effect of this condition on the growth of the limb. The size of the limb was very distinctly increased. The evidences of arteriovenous connection were very apparent; one could get the thrill and murmur and could see the pulsation approximately at the apex of Scarpa's triangle. The child is active, running about, but has a marked disproportion between the limbs, the injured one being three-quarters inch longer than the other, and one inch greater in circumference, showing the influence of this condition upon the nutrition. One would expect that the nutrition of a part was best carried on by the normal arrangement, but according to this case it would hardly seem so.

DR. JOHN B. ROBERTS said that it had long seemed to him that the nomenclature of this condition was bad. We say arteriovenous aneurisms or aneurismal varix and varicose aneurism. Years ago he suggested that it would be much better if they were called arteriovenous fistulæ. Simple arteriovenous fistula and sacculated arteriovenous fistula were the names which he then suggested. There is a similarity to aneurism, but that term should be restricted to a tumor made up of coats of an artery.

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THE DETAIL MAN

BY J. O. ARNOLD

Among the many factors influencing the practice of medicine of the present day, the "detail man" is by no means the least important. Whether we wish to admit it or not, it is a demonstrable truth that the various enterprising pharmaceutical houses of the country, through their literature and representatives, are exerting a far wider and more subtle influence over the therapeutic treatment of disease to-day than all the medical schools of the land. I realize that this is a rather sweeping statement, but it is one the truth of which, I think, is so evident that I scarcely need stop to support it with any extensive argument.

They are backed by ample resources; they are equipped with the most modern facilities; they employ the most expert chemists, bacteriologists and pharmacologists. They do research work and are constantly inventing, devising and testing and working out the hundred and one different problems that these later days are bringing up in medicine and surgery, and are thus doing a necessary and most important work that the physicians themselves cannot do and that is not yet properly provided for in the medical schools or other rightly constituted establishments.

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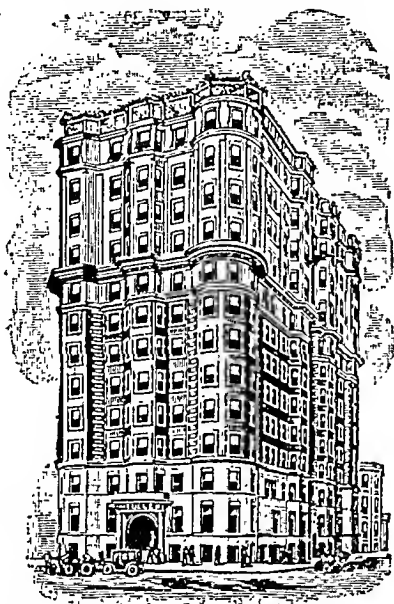
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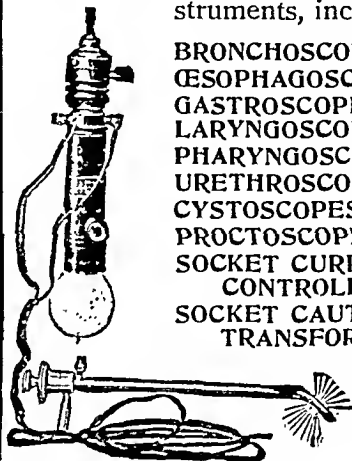
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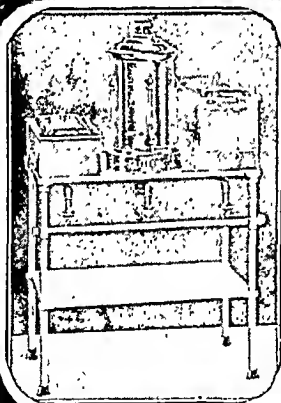


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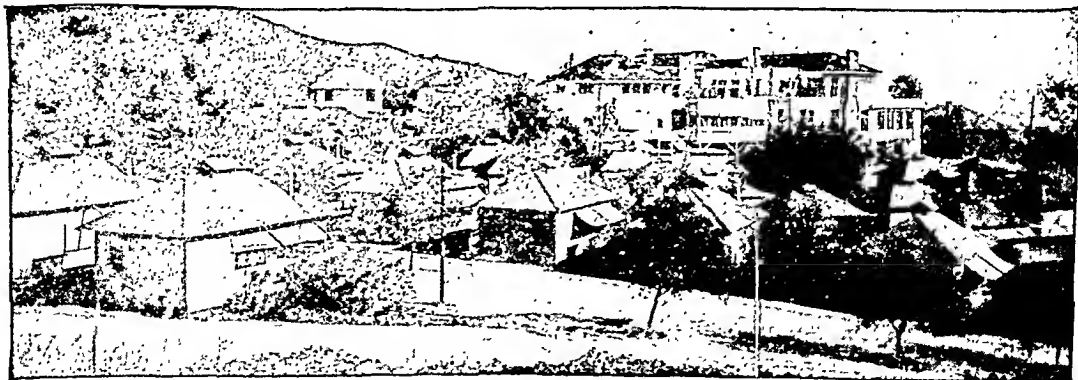
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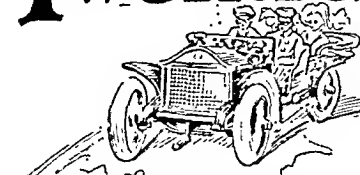
is especially valuable when there is torpidity of the bowels or intestinal sluggishness arising from organic derangement of the liver and kidneys. It is the best agent for the relief of that form of costiveness that is ushered in by an attack of colic and indigestion, and not only clears away the effete and irritating matter in the alimentary tract but eliminates the semi-inspissated bile that too frequently induces the so-called "bilious" condition; at the same time an abundant secretion of normal bile is assured, thereby demonstrating its value as a liver stimulant and true cholagogue.

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CAR-TIME

By Minna Irving

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 Their soldier coats display,
 The woodpeckers are drumming too,
 In March time every day,
 And though the warming air is raw,
 And winds are damp and cold,
 The crocuses and daffodils
 Are showing signs of gold.

So go and get the magazines,
 I want to scrutinize
 The pages where from month to month
 The autos advertise,
 For when the wild geese overhead
 Are honking near and far,
 And roads invite us to a spin,
 It's time to buy a car.

OVERHAULING THE CAR

By Churchill Williams

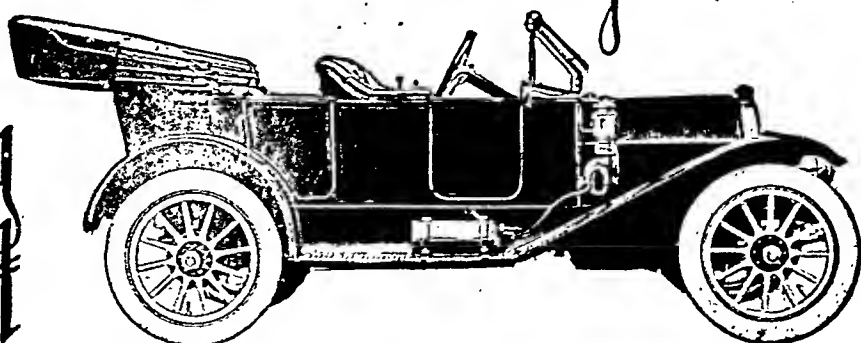
ECONOMY and satisfaction in the operation of the automobile depend nothing more certainly than prompt and careful replacement or refitting of moving parts as they become worn by use. Much can be done to lessen the need for this by keeping the car clean and by attention to small quickly-made adjustments. But a time arrives when wear from friction demands more radical treatment, and this usually involves such dismemberment of vital parts that the car must be laid up for at least several days. It is well at such times to make a "killing" and go over the car from end to end, cleaning its mechanism in

detail as cannot be done when it is assembled, examining its members for condition and fit, and finally reassembling and readjusting these.

Supposing that the owner intends to do this work for himself, or at least, to have it done under his personal direction, the following suggestions are offered. I would preface them with this advice: First, if you have not attempted such work before, engage a first-class machinist to advise and assist you; in any event, do not economize to the extent of denying yourself a helper. Second, be systematic and certain of the reason for each step before you

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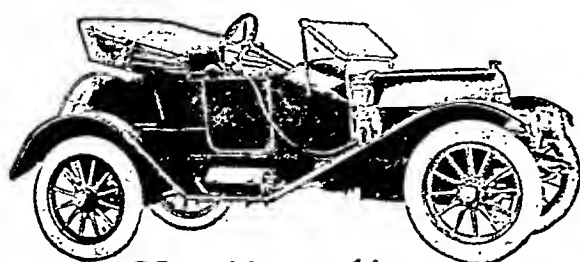
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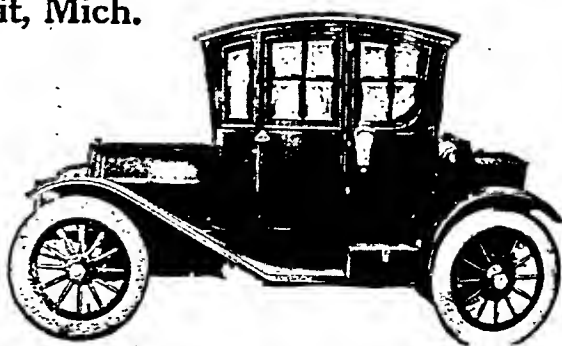
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take it. Third, keep all small parts in boxes or cans, a separate container for each set of parts, and, where possible, run the nut on the bolt to which it belongs immediately after washing them both with gasoline. Fourth, do not attempt to work where you have not plenty of light.

If the motor is so located as to be readily demountable, by all means remove it from the frame at the start. Fastened to a couple of stout horses, which have been braced together, it is in a position to be examined and worked upon with much greater ease and certainty. In any event, after shutting off the gasoline and draining off the water and oil, strip the motor of water, electrical, gas and exhaust connections, and wipe it clear of oil and grit with a rag and gasoline. Then, before removing the valves, test each cylinder separately for compression, either by the rough-and-ready method of comparing the back-pressure upon the cranking lever, or, better by a pressure gauge screwed in turn into each of the spark-plug orifices. Make a note of cylinders showing the lightest compression and, later, when examining the cylinders, pistons and piston rings, refer to this note for guidance in determining the particular rings, valves or valve plugs, if any, at fault. Also, after dropping the lower part of the crank case and before removing the lower half of the crank shaft bearings, test those bearings for

play by inserting a heavy stick between the flywheel and the floor of the workshop and, using this as a pry. Play sufficient to cause a loss of power and sometimes a decided knock, when the motor is pulling heavily, will show itself by this plan and yet fail to disclose itself if simply felt for by lifting the flywheel with the arms unassisted. Likewise, after the crankshaft bearings have been scraped and refitted—if that be found necessary—the lever will again be required to determine if all the play has been taken up. Too close a fit of these bearings is quickest discovered by turning over the motor by hand after the bearings have been bolted as tightly as the wrench will allow. If the operator, using his full strength on the cranking lever can revolve the shaft, its bearings may be deemed not too tight, as a very few miles of running under power will reduce the high spots on them and restore normal conditions.

To accomplish a satisfactory fit of the crank-shaft bearings it is usually sufficient to take out one or more of the thin shims or liners, which are to be found between the edges of the bearing itself. This makes up for the up-and-down wear which, except in extreme cases, will be found to be about all that the bearings have sustained. In some instances, however,—and always for a perfect job—scraping of the bearings will also be required in order to restore them to

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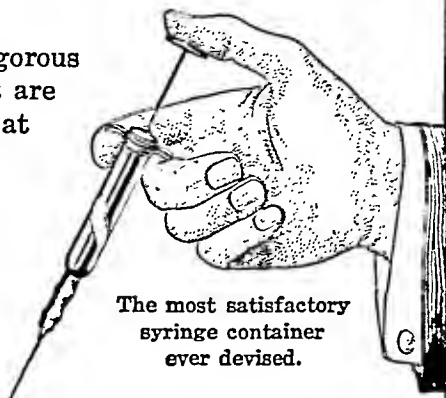
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absolutely cylindrical form. If this is to be done the cylinders must be dismounted and the connecting rods loosened at their lower ends, the crank-shaft, together with the fly-wheel, entirely removed, and the bearing caps and bearings taken out. The scraping of all split bearings of bronze or white metal, is best effected with a special tool that may be purchased at any of the larger supply houses. This tool has a straight cutting edge which must be pressed against the bearing so as to engage its face for its whole length, and a thin scraping taken off at each stroke by giving the tool a slightly rolling movement. The operation requires great care and some little skill and, it should be performed by a good mechanic, or if by the owner, then only with caution and with frequent fittings of the two halves of the bearing about the shaft. By giving the inside of the bearing a coating of red lead and turning the shaft, each fitting will show at just what points the bearing touches or fails to touch the shaft, and so indicate to the workman where the bearing needs further scraping, if any.

The connecting-rod bearings at both ends may have some end play. But up-and-down play, however slight, is absolutely not to be permitted. At the piston-pin end such play is unlikely to occur, except in engines that have had hard, long, use. If play is found it must be taken up, either by replacing

the bushings in the bosses of the piston, or by refitting the bearing that is within the connecting rod end itself, the course to be pursued depending upon the position of the bearing in question. In either case this will probably prove to be a job for a machinist. In some motors the connecting rod is "pinched" upon the piston pin, and the bearing is upon the metal surface of the boss of the piston. About the only remedy for play in such case is the reboring of the piston bosses and of the connecting rod as well, and the substitution for the old pin of a new specially made pin of exactly the right size. Obviously, this is a job for the machine shop and expert mechanic, and not for the amateur.

At its big or lower end, the connecting rod is usually furnished with shims, like those on the crankshaft bearings, and the course to be followed is similar to that pursued in taking up looseness in the latter. To test the fit of the big-end bearing, after it has been drawn up as tight as the bolts through its cap will bring it, the connecting rod should be rocked to and fro. Any serious binding of the bearing, will at once be disclosed by this motion, and should be relieved by additional scraping, or possibly by the reinsertion of one of the thinnest shims.

The bearings of the cam shaft or shafts, and of the magneto or water

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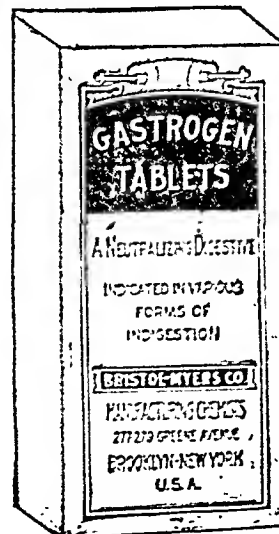
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pump shafts, if either of these has such a shaft to itself, must be similarly attended to, where provision has been made by the maker for taking up wear. In some motors, however, the end bearings of such shafts are solid, and, if decided play is found in them, the only thing to do is to put in new ones. As part of the overhauling of these parts also it is important that they be examined against badly-worn cams or worn or broken teeth in the gears which drive them. In no case should such defaced cam shafts or gears be put back into the motor. Noise and loss of power are the certain accompaniments of the presence of these defective parts.

Turning to the pistons, these should be scraped free of any carbon on the heads, and then given a bath of gasoline and another of kerosene. After they have been dried the rings should be examined for fit and condition. Any ring that binds should be loosened and thoroughly cleaned. Any ring that is lacking in spring or is not bright all around its outside circumference, should be discarded and replaced with a new one. The cylinders themselves should be scraped free from all carbon, especially on the heads and in the passages leading to the valves, after which they, too, should be thoroughly cleansed in a bath of kerosene. Next the valves should be ground in with one of the valve-grinding pastes or with emery powder, extreme care being taken that no particle of this abrasive material adheres to the valve

pockets or valve-stem guides, or to the cylinder. Wiping all surfaces with an oily rag, followed by immersion of the cylinder in a pail of gasoline, should effectually guard against this.

Finally, turning to those parts of the motor that were detached before beginning the refitting of the bearings, each of these should be thoroughly cleaned externally with a gasoline-soaked rag, and afterward wiped dry. The oil pump and the oil pipes leading to and from it should be flushed with gasoline, the grease cups similarly treated, and all small screws or bolts appertaining to the pump set up tight. The water pump is unlikely to need more than cleaning and an examination for possible looseness; the same being probably true of the magneto, which, by the way, is something the inexperienced man will do well to let severely alone as long as it does its work. It should be added that the magneto should not be removed from its base until, with a punch, or similar tool, the two sides of the flexible coupling on its shaft have been marked so as to insure the correct "timing" of the magneto when it is replaced. The exhaust pipe and muffler, may call for some cleaning from soot, and, on general principles, the carburetor should be drained and examined to be sure that its float and air valve are functioning properly.

These things done, the power plant of the car may be regarded as ready for remounting.

(To be concluded in the May number.)

Earle

Diseases of the Anus, Rectum, and Sigmoid

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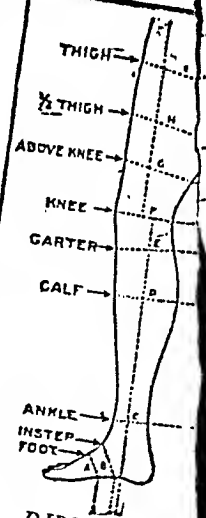
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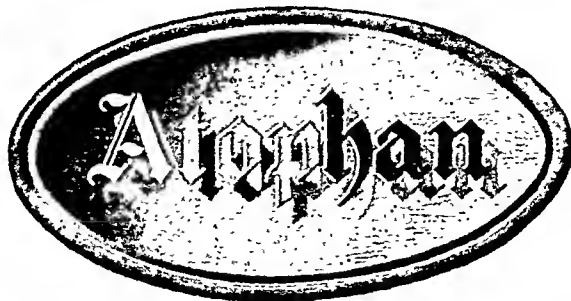
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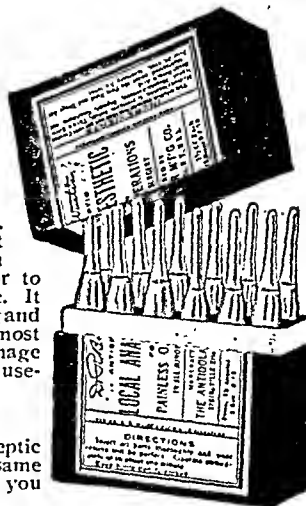
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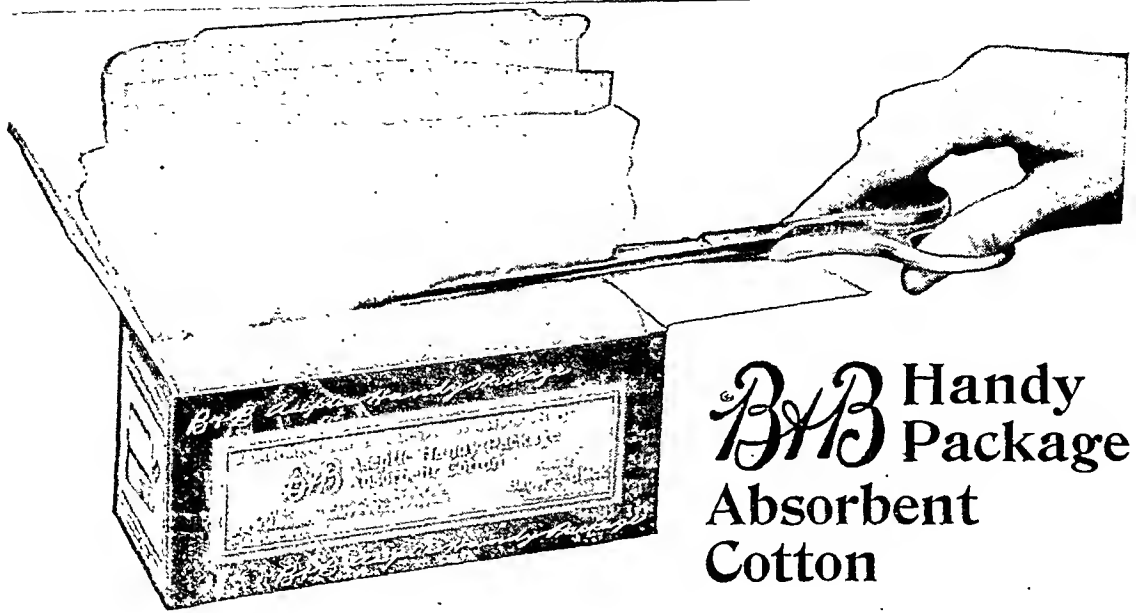
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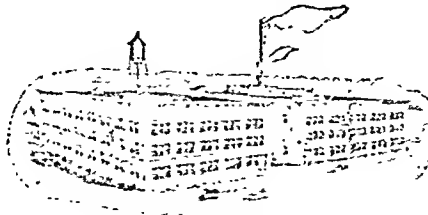
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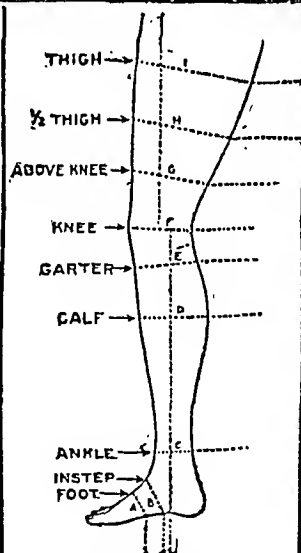
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ANNALS OF SURGERY

VOL. LV

MAY, 1912

No. 5

ORIGINAL MEMOIRS.

ESTIMATION OF VITAL RESISTANCE OF PATIENT WITH REFERENCE TO POSSIBILITY OF RECOVERY.*

BY JOSEPH C. BLOODGOOD, M.D.,

OF BALTIMORE, MD.

Associate in Surgery in the Johns Hopkins University.

THE art of surgery is further advanced in the estimation of the vital resistance of the individual or the factors of safety than the science of surgery. Our instruments of precision are limited and our methods of exact estimation of function are few. In addition, even with these, the average surgeon has not had much experience.

For the estimation of the factors of safety during operation and the condition of the patient directly after operation, it is my opinion that the blood-pressure apparatus is the most important. In the last year I have attempted to record blood-pressure measurements before, during, and after all operations, with the result that I have found these records the most important method of estimating the exact condition of the patient. Before operation the blood-pressure cannot always be depended upon as an index of the vital resistance.

The estimation of the function of the kidney is next in importance. I cannot in this short discussion consider the

* Read in the Section on Surgery, Medical Society of the State of Pennsylvania, September 27, 1911.

details, but it is my opinion that this functional test should be made as often as possible before operative intervention.

Every surgical operation is a depressant in relation to the so-called vital resistance of the individual or his factors of safety. It is a weight to be borne or carried. All the factors of the intervention summed up must be less in their burdening capacity than all the factors of safety or vital resistance in their carrying capacity, or the patient dies.

It is my opinion that surgeons must divide operations, first, into two great classes: those which are for the relief of conditions which of themselves are producing at the time little or no depression of the individual, and for conditions which are of themselves depressant. In the first group, therefore, the operation adds a burden but takes none away, while in the second group, although the operation itself burdens for a time the individual, yet it relieves the individual of a burden which he was carrying before the operation.

Some examples will make this most essential distinction clearer. A man with an ordinary inguinal hernia retained by a truss is practically free from any discomfort, burden, or depression by such a hernia. The operation will bring no relief in that sense. The successful operation will allow him to discard his truss and relieve him of any danger of future strangulation. Such an individual, in apparently perfect health from the ordinary pre-operative examinations, may be made very uncomfortable by the operation for the relief of the hernia with the ordinary pre-operative treatment and ether anæsthesia.

The same individual with a strangulated inguinal hernia will exhibit after operation less evidence of depression, because the operation relieves the patient of pain, of nausea and vomiting, and of the toxæmia present in all cases of intestinal obstruction. It is possible that the burden imposed by the operation may be less than the burden previously carried by the patient. In such a case, at the end of the operation the patient's vital resistance is greater than before. I have frequently observed such a condition of affairs in

early intervention for typhoid perforation, acute hemorrhagic pancreatitis, and perforation of gastric ulcer.

It is very important, therefore, for the surgeon to investigate the individuals who are to be operated on for lesions like non-strangulated hernia with unusual care, and so plan the operation and anæsthesia for the relief of this condition that the burden is kept well within the factors of safety.

Progress of surgery must be developed along lines in which not only the operation gives immediate relief, but the patient recovers and the probability of the permanent cure is increased.

Pre-operative Treatment.—In this period the diagnosis is made, and the patient is prepared for operation. It must be settled: first, that the patient has a local condition for which an operative intervention gives the greatest promise of an immediate and permanent cure; second, that the general condition of the patient is of such a character that the burden of the necessary operation for the relief of the local disease is well within lines of safety. This pre-operative period varies in time. When the local disease threatens life there is no time for any preparation. Here the danger of delay is greater than any danger of the operation. The risk must be taken. In emergency surgical cases the only question, therefore, to settle is whether the danger of delay is greater or less than the danger of the operation.

In all cases in which there is no danger from delay there is afforded further time for studying the general condition of the patient and estimating the factors of safety.

In the past, both in medicine and surgery, too much attention has been focussed on the local lesion and not enough on the general condition of the patient, and it is for this reason that we are not prepared to-day to estimate with a sufficient degree of certainty the vital resistance of the individual.

The factors to be considered are the individual, which means the general condition; the disease, or the local condition; and, last, the operation for the relief. In the pre-operative period of investigation and treatment we study the individual. The blood count is a scientific estimation of the

presence or absence of anæmia, and we know that different types of anæmia and leucæmia lower the vital resistance. By the ordinary methods of physical examination we can estimate to a certain degree the circulation and respiration. Lesions here are risks of different degrees, but to-day we have no unanimity of opinion in regard to the operative risks on patients suffering with various types of cardiac lesions and lesions of the lungs.

With nitrous-oxide-and-oxygen anæsthesia my accumulated experience leads me to the conclusion that it is not harmful in lesions of the heart and lungs, that the element of danger in operations upon such individuals is more the operative intervention than a general anæsthesia of this kind.

Certain general conditions undoubtedly decrease the vital resistance or factors of safety, and they are well known: mechanical or psychic shock; general infections and toxæmia, metastasis from malignant disease, cerebral pressure, anything that interferes mechanically with respiration, and a weak cardiac muscle with dilatation of the heart. These general conditions are not so difficult to diagnose as to estimate how much of the factors of safety they have removed and what there is left with which the patient may withstand the contemplated operation.

During this period the estimation of the function of the kidney should be done.

In view of the fact that at the present time our scientific methods of accurately estimating the vital resistance of the patient or the factors of safety are to a certain extent so unreliable and the factors themselves so numerous and the problems so complicated, it is my opinion that every patient should be given the benefit of every doubt and prepared for the operation with the greatest care, that the operation be performed under the least dangerous anæsthetic, that the manipulations of the operation be made with the least degree of trauma and loss of blood, and that the post-operative treatment be planned to reduce as far as possible any depressant factors and to give the patient the benefit of any improvement in treatment.

As far as possible, therefore, all patients should be treated, without their knowledge, as if they were very ill. These handicapped patients are comparatively few in numbers, and if we wait and employ this more difficult technic for this group only, I am certain that the development of the technic will be very slow.

Take nitrous-oxide anæsthesia, for example. We have been getting along very well with ether given by the drop method on the open cone, and for the ordinary healthy individual and for the ordinary operation it is good enough. But for the handicapped individual, and especially for an extraordinary operation upon one of this class, nitrous-oxide anæsthesia is far less dangerous than ether. But no clinic can develop the technic of this narcosis if it is selected for the handicapped cases only. Everyone must be narcotized with it, and it will soon be found that nitrous-oxide anæsthesia with its various combinations is better for all patients. It is pleasanter to take, the post-operative discomforts and dangers are distinctly less, and for extraordinary operations on healthy individuals and any operation on the handicapped individual it is life-saving.

This, therefore, is the second point of this paper: the development of a course of treatment before, during, and after operation to be employed in all cases, which has for its object the reduction of the risk and of the discomforts of operative intervention. Not until this is done will any surgeon or any clinic be able to estimate what is the best method of treatment. There is no doubt that every operation to-day has its mortality; post-operative discomforts, complications, and deaths are still observed. Then there are the late post-operative lesions, usually of the nervous system, so-called neuroses. The facts, therefore, justify my statement that we have by no means reached our best method, either of estimation of the vital resistance or of a method of treatment which will reduce the operative risk to a minimum, but we have made great strides toward this. In brief, they are as follows:

Greater care and more time should be spent in the study

of the local disease and in the investigation of the general condition of the patient. Emergency operations should be performed earlier and operations which are not of this type should not as often be undertaken without the proper pre-operative study and treatment.

In the pre-operative diagnosis, instruments of precision should be employed—the X-ray, the blood-pressure apparatus, all of the clinical and laboratory examinations should be made; the patient should pass through this in such a way that no fear is excited and that it does not become an ordeal. During this period of diagnosis, therefore, treatment is by no means neglected. In the first place the psychic condition of the patient must be borne in mind, everything should be done to allay fear, establish confidence, in fact give mental rest and recreation. Next should be considered the emptying of the intestines by proper catharsis, the pre-operative diet. The details of this I cannot discuss, but every essential feature should be carefully investigated. It is my opinion that the patients are more comfortable if they have no cathartic later than 36 to 48 hours before operation, and that in all abdominal cases they should have no food except water and albumin for 48 hours. This treatment, of course, varies with the individual, with the disease, and with the general condition. The longer a patient can be free of alcohol before an operation the better. Very fat people should be starved for some days; the diabetic patient should not be starved. With lowered renal function the patient should be given rest in bed, restricted food, plenty of water, and a permanent catheter in prostatic cases.

There are many factors to be considered in a pre-operative treatment for those cases in which the operation is not an emergency one. In general it is my experience that as a rule certain things are neglected in the majority of cases. These are the more careful investigation of the general condition of the patient, the estimation of the kidney function, and the blood-pressure record. I am quite certain that an investigation of this kind will not add to the anxiety of the pa-

tient. It no doubt adds to the burden of the surgeon and his associates, and to the expense to the individual in the hospital, but the time is fast coming when the individual who can afford to pay for it will expect and demand these more modern, more exact methods of diagnosis.

Every hospital should be sufficiently endowed so that its public patients may have the benefit of these methods of exact diagnosis. The time will come when a Wassermann blood reaction will be made as often as a blood count. In the past these methods of diagnosis have been underdone, and in the future, I am confident, it will be better to err on the side of overdoing.

What preparation will increase the factors of safety? I am confident that certain general rules in regard to ordinary daily life can be utilized. After any work there is fatigue and for recuperation there must be rest. This physiological law is well established. The work of the cell, whether of the nerve, muscle, or gland, is accomplished by a chemical reaction in which the cell gives up something of its vital energy. During the period of activity energy is expended and not stored, so that there must be a period of rest to restore the cell to normal. If work is continued without the proper period of rest, the cell in time becomes incapable of restoring its energy and may be looked upon as a dead cell. Of course there is every grade of exhaustion from the early fatigue to the dead cell.

The individual who is but a combination of such cells may be looked upon by the surgeon as a physiological unit, a cell; and the first question to answer is, How much rest does this individual need before he is subjected to operation? This period of rest depends upon whether the patient, physically or mentally, has been overworked, and in what stage of exhaustion are his cells, especially the brain cells and the cells of his excretory organs. Now, as a matter of fact we have no scientific method of estimating this. If we can come to the conclusion that the disease itself is not increasing the degree of exhaustion, then there should be a delay to give the patient

physical and mental rest. We all know that rest, mental and physical, is a difficult thing to give the ordinary individual at his home. It is best accomplished with the majority of cases at the hospital. There are, of course, exceptions to this rule. The next important factor in the pre-operative treatment is fresh air. It is very difficult, especially with most of our patients, who have become accustomed to the overheated, close atmosphere of most homes and office buildings, really to keep them at rest in fresh air.

Most individuals over-eat. Therefore, the intestine should be freed by cathartics and the diet should be restricted. Water should be given in larger quantities. There is no doubt, it seems to me, from the experience in the literature and from my own, that alcoholics should be total abstainers before operation.

Now, practically all surgeons are agreed as to physical and mental rest, as to fresh air, as to restriction of food, as to the increase of water, as to the cutting out of alcohol and tobacco, before operative intervention. For the ordinary healthy individual the period may be short, 48 hours, the time increasing after this according to the individual and his handicap. But the point I wish to emphasize here in conclusion is this: Surgeons have not made a careful, scientific investigation as to the best pre-operative treatment for all patients, and especially for handicapped patients, and, more important, for the different kinds of handicap. How shall the patient with myocarditis be prepared? Undoubtedly in the same way that the physician would treat his heart lesion, whether he is to be operated on or not. Shall we give cardiac stimulants in heart cases previous to operation? I do not know any one who could answer this question. This is not the place to discuss the preparation of the different types of handicap, nor, if it were the place, have I had sufficient experience with any one to speak with authority.

As far as I can deduce from my own experience and from the literature, the best pre-operative treatment to-day is general rather than special. It is the treatment that is harmless

to any one, beneficial to all, even if not required, and life-saving, undoubtedly, to a small proportion. This general treatment is rest, physical and mental, fresh air, restricted diet, moderate catharsis, increased water, restriction or complete elimination of alcohol and tobacco. I am confident that in time we will add massage and baths. Undoubtedly it would be better if, during these days of pre-operative treatment, we could create such an atmosphere or environment that the patient would be amused and entertained. To increase the number of hours of sleep and to make the waking hours enjoyable, is an environment in which the exhausted nerve cell has the best opportunity for rest and restoration of its energy.

Apparently specific treatment, except such things as quinine for malaria and salvarsan for syphilis, we have none. I might discuss diabetes, but the most recent medical literature concludes that there is no specific treatment, and each case must be considered by itself and the sugar tolerance found by experimenting with different foods.

The Treatment during the Period of Operation.—In the beginning of surgery, before anæsthesia, surgeons thought of practically but two things, time and hemorrhage. That is, to get the operation finished as quickly as possible and with the loss of as little blood as possible. After Lister's antiseptic methods, the surgeon became responsible for infection of the wound, and attention was turned chiefly to technic which would eliminate all sources of danger of infection. Not much attention was given to anæsthesia in those days. Chloroform was the anæsthetic of choice. Then ether gradually replaced chloroform, because it was safer. That ether has its dangers is indicated by the introduction of local methods of anæsthesia, intraspinal and intravenous anæsthesia. Surgeons, having perfected the technic of controlling hemorrhage, of preventing infection, and the various technical details of operative measures, have at last turned their attention to anæsthesia. Chloroform is given less, ether is given better. The trained, experienced anæsthetist has come, and now we

are investigating whether nitrous oxide and oxygen should not be the routine method of anæsthesia in all cases. Crile has added to this the local infiltration of the operative field, as the surgeon proceeds, with novocaine (1:400). This is by no means new. The combination of local and general anæsthesia is as old as local anæsthesia. But Crile at the psychological moment emphasizes its importance. The object of the local anæsthesia is to block as many nerve impulses as possible from the field of operation. There is no doubt that operative shock is caused by such impulses. General anæsthesia may protect the individual in his unconscious state from feeling them, may obliterate his memory centres, but the general anæsthesia does not entirely protect the nerve-cells from these afferent impulses. Chloroform and ether act injuriously directly upon the nerve-cell. There is no doubt about this. It looks very much as if the days of ether and chloroform were numbered. Apparently nitrous oxide, as far as our methods of estimating go, is harmless to the nerve-cell. It leaves no toxic substance in the body to be eliminated, it increases little if at all tissue waste. This anæsthesia, therefore, does not of itself produce fatigue or exhaustion of the nerve-cell or any other cell. It is therefore the anæsthetic of choice. Crile is of the opinion that the toxic action of novocaine, which is very slight, has far less deleterious effects than the afferent nerve impulses which it inhibits.

I employ nitrous oxide and oxygen as a routine in St. Agnes Hospital. Dr. Halsted introduced it and employs it in his clinic at the Johns Hopkins Hospital. Crile uses it in all his cases in Cleveland. The literature is full of reports on this method. Surgeons, therefore, to be up with the times, must heed this warning and instruct their anæsthetists at once to familiarize themselves with this method. Nitrous-oxide-and-oxygen anæsthesia should never produce cyanosis. It cannot be looked upon as quiet anæsthesia, it makes the surgeon's work in some operations more difficult, but it is always best for the patient. The surgeon will have to accustom himself to this anæsthesia. In abdominal work the infiltration with

novocaine gives relaxation of the muscles, but for deep pelvic work or exploration around the common bile-ducts one will find it more difficult to keep the intestines back. Yet, as experience grows, dangers and difficulties which at first seem real are found to be apparent only. The patient should always be given morphine and atropine half an hour before the administration of this gas. In some cases the morphine may be repeated in small doses. Not infrequently ether will have to be given a few drops at the time. One should expect anæsthesia from this gas in at least five minutes. If this does not occur, see if the gas is all right, if the apparatus or bags have no leaks. Excluding these possibilities, then there is the indication that the patient needs a little ether. But this is not a paper to discuss the best method of administration of this newer anæsthetic. The surgeon and his anæsthetist should have in mind that at the present time we should attempt to get along with as little ether as possible.

We have prepared the patient for the operation, and we have chosen the best anæsthetic and the most experienced anæsthetist. Shall the patient be anæsthetized in the room, or brought to the operating table prepared and then anæsthetized, or shall we employ any compromise between these two extremes?

One should choose the method which gives the patient the least fear and anxiety. I find that the majority of patients do just as well when they are brought to the operating table prepared and are then anæsthetized, but in some cases the gas should be given in the patient's room at an unexpected time. They may be prepared for this by Crile's method of stealing the thyroid gland. In regard to this point I feel that we are sure of only one thing, and that is the nitrous oxide and oxygen as an anæsthetic and the skilled anæsthetist. The other features may be unnecessary elaborations.

The prepared patient is now under nitrous-oxide anæsthesia. We can do little during the operation to increase his factors of safety. All the surgeon can do is to attempt to keep well within safe limits. With the ordinary healthy in-

dividual and the ordinary operation it is easy sailing. One perhaps need not look often at the barometer or compass. But with the handicapped patient and the extraordinary operation the surgeon is in a dangerous position. He needs all his art, all his acute senses of observation, and instruments of precision to help him, to warn him when to stop if he cannot finish. Operations in two or more stages are more frequent to-day than ever before. It is due to the fact that surgeons feel that they should be able to tell when to stop, so that every patient will recover from the operation. During the last year I have paid considerable attention to routine blood-pressure records, and at the present time I am getting the impression that the blood-pressure will warn the surgeon of the danger-line before the pulse or the respiration. My respect for the blood-pressure record is increasing daily, and I would urge all surgeons to use it in extraordinary operations and handicapped patients. But to learn to interpret these records, one must employ them at all operations as a routine. What can we do during the operation, outside of prevention, to increase the factors of safety? We can give salt solution per rectum, subcutaneously, and intravenously, or blood transfusion, and I know of nothing else. I believe all stimulants are contra-indicated. I am uncertain as to the value of coffee in a hot rectal enema. I often employ it. When the blood-pressure falls to 100 or lower, it is time to stop the operation and time to give the saline, which in such instances should be given immediately. I have had a few such cases with very happy results.

There is one point I wish to make clear which many surgeons do not seem to be familiar with. The patient seems in fair condition at the end of the operation, but no blood-pressure record is taken. He is lifted to the stretcher, carried to his room, and when put to bed is found to be in collapse requiring hurried treatment. This can be avoided in most cases if, after the operation is finished and the bandage adjusted, a blood-pressure record is taken. If this record is much lower than that taken at the end of the operation, it is an indication

that the patient should not be transported but kept quietly on the table and given the salt solution by one or all three methods. It is important, therefore, carefully to investigate the patient before he is lifted from the operating table to be transported, and to begin this post-operative saline treatment then if indicated. I am confident that this will prevent many of the cases of collapse or sudden vasomotor shock which are observed after the patient reaches his bed.

The shock in a surgical operation is first psychic. This does not begin the morning of operation, but undoubtedly acts from the moment when operation is suggested. The effects of such psychic impulses vary tremendously with different individuals. In some cases this psychic shock may be so intense that every method should be employed to avoid it. The possibility of an operation should be kept, if possible, from the patient. The patient may be sent to the hospital with the understanding that it is for diagnostic purposes only, and the operation can be suggested at the last moment. It is not necessary to discuss here the various methods and schemes which may be employed to reduce psychic shock. If the patient has absolute confidence in the surgeon, in the family physician who referred him to the surgeon, and in the nurse, and the hospital is one of his own choice, he has created for himself the best conditions to allay fear and psychic shock. There is no substitute for such confidence, and the surgeon is handicapped from the beginning if he has not the confidence of these patients.

In our attempt to bring the patient to the operation without his knowledge until the last moment, we may defeat our own aims and create in the patient's mind an exaggerated idea of the gravity of the operation. As a rule in my own experience, if I have the confidence of the patient I do not hesitate to speak in a natural way of the operation as an incident of treatment, and try by describing to him the newer and more modern methods to demonstrate that the operation is not an ordeal, and thus allay his fears. Nevertheless, in some cases all methods fail. Perhaps in this group the preliminary of

scopolamine and morphine will find its field of usefulness. One should hesitate to operate on an hysterical adult or frightened child, if the operation can be postponed with the hope that at the next attempt fear can at least be reduced. I have found that a patient, adult or child, who is nervous or hysterical before gas is administered, does not take the anæsthetic so well, and on a number of occasions I have postponed the operation.

We have by no means reached a satisfactory position in our prevention of psychic shock. There is ample opportunity for investigation in this line. Undoubtedly the more the good results of surgery are known to the public at large, the more will the prevailing fear of operation be diminished.

The surgeon must be familiar with the manipulations which produce shock. Nothing helps him more to estimate this than the blood-pressure. It is to be remembered that anything that either diminishes or increases the blood-pressure is a stimulation which sooner or later will lead to exhaustion and a fall of the blood-pressure. It is the uniform rate of pulse and respiration and the uniform blood-pressure that indicate an operation with the least degree of shock. During the entire resection of the colon with the anastomosis, if done without tension on the mesentery, one will observe very little change in the pulse, respiration, or blood-pressure, but the moment one pushes the intestines away, to suture the rent in the posterior peritoneum caused by the removal of the colon, the quiet patient moves, the pulse and respiration are more rapid, the blood-pressure rises at once, and if the patient's factors of safety are small, the blood-pressure quickly falls and the patient is in shock. The previous manipulations may have taken an hour or more, and these manipulations but twenty to thirty minutes. Now, it is such manipulations that the surgeon must avoid if possible. Better a long operation without these manipulations than a short one with them.

The question as to who shall be the anæsthetist must be decided in each clinic. I prefer a member of the surgical staff. I look upon anæsthetization as a stepping stone to

operative surgery. It is only a medical graduate who can really understand the problems in physiology which are to be investigated and solved in expert anæsthetization. The surgeon can work better with a trained medical mind giving anæsthesia than with any one else. It is also my rule that the chief anæsthetist ranks next to the resident surgeon, and anæsthetization is the duty of the senior and not the junior member of the staff. But, of course, this question is by no means settled.

Post-operative Treatment.—In the post-operative treatment we must consider the position of the patient; how water shall be given continuously for the next few days; how rest and sleep shall be induced, that is, how much morphine; what shall be given by mouth.

The immediate post-operative shock, if any, should have been treated in the operating room, as I have most emphatically stated.

When the patient reaches the ward or room, it has been my rule to start salt solution per rectum by the continuous method of Murphy in all cases, until the patient is able to take enough fluid by mouth to maintain kidney function. In my experience the amount of urine voided in the first 24 hours should be 1000 cubic centimetres or more, and proctoclysis should be maintained until this is accomplished. The giving of continuous salt solution per rectum by the method of Murphy is distinctly a problem for the trained nurse. It is her duty to become efficient with this method. When for any reason this method fails, the salt solution can be given subcutaneously at intervals of 4, 12 and 24 hours, alternately in the axilla and beneath the pectoral muscle.

Water and the white of egg can be given in most cases at once after operation, by mouth.

In most cases the position of the patient can be that in which he is most comfortable. Apparently for old people and for cases in which peritonitis is present or threatened, the Fowler position (sitting up) seems best. But this can be overdone. What one should seek is a comfortable position,

and to encourage, even command, change of the position by the nurse or the patient himself.

Morphine is not contraindicated in small doses for the first few days after operation.

This should be a routine for all patients. If this is followed, apparently the post-operative complications are less frequent and, when they do arise, the patient is in a better position to withstand them.

Post-operative Complications.—The first to be considered is disturbance of kidney function. This is often foretold by the test previous to operation and one after operation. When there is anuria with or without albumin and casts, we can push the salt solution a little more energetically, in some cases intravenously. We can give spartein and diuretin, the latter in cardiac cases. If there is no contraindication, elimination should be encouraged by the alimentary tract through catharsis, and through the skin by heat. One should be careful not to make these measures too energetic. One also should not over-stimulate renal function.

Dilatation of the stomach should always be looked for. Vomiting of a dark-brown duodenal fluid is an indication for lavage. Epigastric distress and distention should lead the surgeon to wash out the stomach, even if the vomiting is absent and the characteristic rapid pulse and depression of acute dilatation have not shown themselves. The washing out of the stomach for this complication is almost specific. After emptying the stomach of its contents and washing until the fluid is clear, it is my plan to leave in the stomach at least an ounce of castor oil. As a rule this lavage should be repeated at any interval if there are any recurrent symptoms, and in at least twelve hours if there are no symptoms, and this lavage should continue until one finds no duodenal contents in the stomach or no gastric residuum. If this rule is followed, the grave condition secondary to acute dilatation of the stomach will rarely if ever be seen.

Abdominal distention is the most frequent of the uncomfortable post-operative complications. Rarely is it absent to a

slight degree. Since the introduction of the continuous salt solution per rectum, all surgeons have noticed that this distention is less frequent and of shorter duration. Patients narcotized with nitrous oxide and oxygen also are to a certain extent relieved. The pre-operative treatment by starvation and no cathartic for 48 hours before operation is another preventive. Nevertheless, we still meet this complication. The best treatment is the rectal tube with enema combined with eserine hypodermatically. The enema should be oil and glycerin to which epsom salts and turpentine may be added, and there are other combinations. But my observation teaches me that one should begin in from 12 to 24 hours after operation with enemas at intervals, combined if necessary with eserine, until the gas is expelled. The indications for these enemas are the characteristic gas pains and abdominal distention. The differential diagnosis between this and obstruction must always be borne in mind. In such cases eserine would give no relief and the washing out of the stomach would relieve the distention only temporarily. But this is not the place to discuss the differential diagnosis.

Now and then morphine given hypodermatically relieves the gas pain and a little later gas is passed. I do not think it is contraindicated in small doses. It should be given when the eserine and the enemas do not give speedy relief. It is a clinical observation of mine for which I have no experimental proof.

Post-operative acidosis must be borne in mind. This is one of the dangers of a long pre-operative starvation treatment, and this treatment should always be checked by examinations of the urine, and the appearance of acetone and diacetic acid should be an indication for food and perhaps, in some cases, for postponing the operation. Post-operative acidosis first shows itself in the urine, next in the breath by its odor, and, last, in coma. One should never wait for coma to institute treatment. In the salt solution which is being given per rectum, bicarbonate of soda and glucose should be added in all cases of acidosis. Food by mouth should be increased. In

more critical cases the stomach tube should be passed, the stomach washed out, and a fair quantity of milk, sugar, and bicarbonate of soda left in the stomach. When coma supervenes the prognosis is very bad. Bicarbonate of soda should then be given in the salt solution intravenously. This subject of acidosis, pre- and post-operative, is coming to the attention of surgeons more frequently in the last few years. We observe it in gastric stenosis from ulcer or cancer when relief has been delayed; in chronic gastromesenteric ileus, and other forms of ptosis in which starvation is imminent on account of the inability to take food.

For impaired kidney function, dilatation of the stomach, intestinal distention from gas, and acidosis, we have fairly certain preventive measures and active measures of treatment. However, over the other post-operative complications we have less control.

The various types of cardiac failure, such as disturbance of compensation in a handicapped heart by the shock of the operation, the tachycardia of Graves's disease, and other types of tachycardia, toxic, psychic, and traumatic; for these we have no specific medication. It is fortunate if the cause was only the operative intervention, because this ceases with the operation, and as a rule in such cases the heart recovers its compensation in time. One, of course, should look to see if a factor is still active and remove it if found. Morphine is helpful in such cases, ice to the heart, and a comfortable position. This position varies. In fat people the heart seems to act better when they sit up, in thin people the reverse may be true. As a rule the head-low position is not the best for cardiac complications, except for the immediate post-operative cardiac and vasomotor shock. There is no specific treatment for post-operative pneumonia. All post-operative patients should be given plenty of fresh air and water, and this is best for pneumonia.

We apparently can do nothing for phlebitis. I have found that thick rolls of gauze wrung out in hot salt solution and

then employed as bandages from ankle to thigh give relief and reduce swelling.

The other complications I will not discuss here.

Post-operative Neurosis and Convalescence.—To a certain extent this is a preventable complication. In the first place the disease for which the operation was instituted may have been the etiological factor of the neurosis and, although the operation may have completely cured the local disease, the neurosis continues as a mental condition which, as we know, has to a certain extent a time limit before recovery takes place. Often before operation the symptoms of the local disease may be such that the neurosis is overlooked. After operation, the symptoms of the local disease having been removed, those of the mental condition come into view. I am confident that many of the so-called post-operative neuroses or neurasthenias are not post-operative at all.

There is every reason to believe that an operation can produce in certain individuals the disease that we call neurosis, neurasthenia, or melancholia. The pre-operative fear and fright, a toxic anæsthetic, the trauma of an operation, the post-operative complications and discomforts are by no means good for anybody, and may be very serious for the individual with an exhausted nervous system.

If all the details of the pre-operative treatment, of the operative anæsthesia and manipulations, and of the post-operative care are carried out, I am confident that everything has been done to reduce the factor of the operation as the cause of a nervous breakdown or the continuation of this nervous condition, present before operation.

This brings up the last point of this article: That post-operative treatment does not end with the discharge from the hospital in many cases. The patient should be under the care of his family physician, and, as most surgeons have had considerable experience with this condition, they can be helpful to the family physician with suggestions.

The operating surgeon cannot accomplish the best results

alone. There are needed in every community physicians who are capable of making diagnoses earlier, so that surgical disease, both acute and chronic, will be brought for surgical relief at a time when the operative mortality is least and the probability of a permanent cure best. These physicians should interest themselves with the surgeon and do their part in the pre-operative diagnostic measures and methods of treatment. They should be present at the operation, to add to the confidence of the patient; they should see the patient after operation. The physician should take entire charge of the patient after the danger of the surgical post-operative complications is over.

In the pre-operative diagnosis the surgeon must have the assistance of a clinician equally trained in his line to look at the medical aspects of the case. Both the physician and the surgeon require a corps of assistants to make the various laboratory examinations or inspections with instruments of precision. There must, therefore, be team work and, to a certain extent, an all-star team to give the operative patient the best chances of recovery.

But there is something in surgery beside recovery from operation. We wish the patient to be permanently relieved. The danger as a rule of an operation which insures permanent relief is no greater than the one which can be called incomplete.

No surgeon can afford to continue his operative work without constantly checking his ultimate results. He must know from year to year what patients he has and what he has not permanently relieved, and he must investigate the group in which the relief has not been permanent, in order to improve his results.

THE WIRING OF OTHERWISE INOPERABLE ANEURISMS.*

WITH REPORT OF CASES.

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THE operation of wiring otherwise inoperable aneurisms, devised in 1864 by Moore, of London, and subsequently modified by Corradi, is one which deserves more general attention and wider use than has up to the present time been accorded it by the medical profession. In fact, outside of this country, it has attracted little attention. Here, owing to the excellent work of Stewart, Hunner, and others, it has been employed in a number of clinics with a measure of success, that, considering the otherwise hopeless nature of the affection, has been fairly gratifying. The technic of the operation worked out by the authors above mentioned has been little modified by later observers. The modifications that have been suggested have been of minor importance. Some question as to the correctness of the conclusions of Stewart and Hunner has been raised by Freeman and others, but experience with a considerable number of patients, 23 in all, in which this operation has been employed, convinces me as to the soundness in the main of their deductions. Those interested in this subject should consult the monographs of Ransohoff, who in 1886 reported the first wiring operation done in this country, Stewart, Hunner, Matas, Freeman, Hare, and the most recent communication upon this subject, that of Eshner, in which he has collected and tabulated 38 reported cases up to May, 1910. To this number, my associate, Dr. B. M. Bernheim, without claiming an exhaustive review of the literature, has added 21 cases, including 18 of my own, hitherto unreported.

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For the benefit of those who may not be familiar with this procedure, it will not be out of place, perhaps, to call attention to a few of the most important points to be borne in mind: in the first place, in the choice of this operation, and in the second place, in its practical application. It goes without saying that cases in which this method is to be used should be selected with great care. It is equally obvious for anatomical and other reasons that methods of treatment applicable to aneurism in other parts of the body do not apply here. The brilliant and epoch-making work of the President of this Society (Matas) in the plastic surgery of the vascular system, the metallic bands of Halsted, and the suture methods of Carrel are in the present state of development of intrathoracic surgery clearly out of place in this region, although much is to be hoped for in the future. The same is true of the older methods, with the possible exception of the needling operation of MacEwen which has never been in general use. Palliation to a slight degree only can be reasonably expected from medical measures. Authentic cases of spontaneous cure are so rare as to warrant no reasonable hope of relief from this source. Wiring, then, is the only effective means at our disposal with which to combat this otherwise hopeless condition, for the tendency in aneurism of the aorta, in the vast majority of cases, is steadily progressive toward a fatal termination. Reason suggests and experience has shown that the only class of case in which this method offers any reasonable expectation of cure is in aneurism of the sacculated variety, especially when of traumatic origin. It is not applicable to and should not be employed in the fusiform variety. The reason for this is obvious.

The morbid condition of the vessel wall which gives rise to the weakening and subsequent dilatation of the arterial coats is as a rule not a localized process, and the usually accompanying increase in blood-pressure is opposed to the establishment of conditions favorable to a cure. An accurate diagnosis is essential in the selection of the individual case in which this method is to be applied. To this end, the X-ray,

especially the use of the fluoroscope, is indispensable, as the pulsation of the aneurism is readily distinguishable by the aid of this instrument.

The immediate risks of the operation, especially in aneurism of the thoracic aorta, are not great. They consist in the possibility of an end or loop of the wire sliding along the wall of the aorta in the direction of the heart and interfering with the action of its valves (its presence in the aorta gives rise to no symptoms), or in the formation of emboli which have been swept off by the blood current. That a loop of wire may even enter the cavity of the heart without fatal result is illustrated by Pasham's case where such a condition was found present at autopsy. That there is a real risk from emboli is well illustrated by a case reported to me by a physician who himself had been the subject of a thoracic aneurism which had incapacitated him from performing his professional duties. I had wired his aneurism with the result that he had resumed his practice in a distant city, and had himself subsequently wired a thoracic aneurism for a patient. In a letter to me, he writes that immediately after wiring the aneurism, the patient complained of pain and numbness in his arm, which at once became blue and went on to the formation of gangrene of the hand and forearm. He was compelled subsequently to amputate the arm above the elbow. The aneurism at the time his letter was written was apparently cured and the patient well satisfied, saying that he had rather have one arm and no aneurism than two arms with an aneurism.

The remote risks arise from emboli or sloughing due to a too strong electric current, sepsis, and from giving way of the aneurismal wall owing to the possibility of the new-formed clot shunting the blood current against another portion of the aneurismal sac. This last possibility has been denied by Freeman, but after wiring, I have seen upon more than one occasion a sudden bulging of the aneurismal sac in some one direction, which could not be accounted for in any other way than by a giving way of the aneurismal wall at that particular point.

While these risks are not great, indeed surprisingly small considering the nature of the affection and the structures with which one is dealing, yet it is only fair that their existence should be explained to the patient or his friends.

The immediate results attending this operation are sometimes most striking. Perhaps the most remarkable of all is the diminution in pain which takes place frequently before the operation has been completed. In a number of instances, the patient while yet upon the operating table has stated that the pain has appreciably decreased. This fact has been so frequently noted that I have felt justified in stating to the patient that even if he derives no other benefit from the operation, he can confidently expect a marked relief from his pain. What is true of pain is also frequently true with regard to dyspnoea which sometimes is very pronounced in advanced cases. The explanation of these phenomena is not altogether clear. One would rather expect that the disturbance caused by the operation itself and the presence of the needle and wire in the interior of the aneurismal sac might produce certain circulatory disturbances which would tend to increase rather than diminish the pain. It is possible that the electric current may exercise an anæsthetic effect. If the relief was due entirely to this fact, however, one would expect the pain to return after the withdrawal of the electric current, but such is not the case. As a rule, the hardening of the clot as shown by the lessening or disappearance of expansile pulsation does not take place for some days or even weeks, but immediate marked diminution in the pulsation of the tumor has been observed in a number of cases. This is not so surprising as the other phenomena to which we have just referred.

As to the technic of the operation, all that is necessary is a hollow needle, of not too large size, insulated with the best quality of French lacquer to within a short distance of its point. Through this, a suitable wire is passed. Various metals have been recommended for the wire. Hunner in his experiments found that a wire made from a silver and copper alloy in the proportion of 75 parts copper to 1000 silver

answered the purpose very well. We have used this in all our cases. The wire is wound tightly upon a wooden spool in order to give it a coil. Care should be taken to avoid kinking, as this interferes with its passage through the needle. After the skin has been cocainized and drawn to one side, the needle is inserted slowly until the arterial blood appears in jets through the needle. The end of the wire which has previously been passed into the lumen of the needle, but not as far as the point, is now passed into the aneurism until the amount wound upon the spool has been inserted into the aneurismal cavity. We have arbitrarily used ten feet. The objection that has been urged against a greater amount is that it prevents the contraction of the resulting clot in the course of its subsequent organization. Freeman and some others believe that the greater the amount of wire introduced into the sac the better. My observations have not borne this out. If the needle is not well insulated, or if it is pushed so far into the aneurismal sac that its shoulder comes in contact with the skin, there is danger that an electrolytic burn may result along the needle's track. The resulting slough decreases the strength of the aneurismal wall, and is liable to cause leaking at this point. Hare calls particular attention to this, and I have observed it in two of my own cases. Care should be taken that the strength of the electric current should not be too great, that is, it should not exceed 75 ma. Charring of the sac was observed in Halsted's case. Here the current was supposedly not greater than 75 ma. Subsequent hemorrhage resulted from necrosis of the sac at the point of charring. The current should be continued for at least one hour. In my later cases, I have continued it for nearly two hours. The positive pole should be attached to the wire, the negative at the patient's back. Disorganization rather than formation of clot occurs at the negative pole. After the current has been passed through the aneurism for the given time, the needle should be carefully withdrawn, making use of a slight rotary motion in order best to accomplish this. The wire should be cut as short as possible, depressing the skin by the point of

the blunt scissors. The skin should be then pinched up with the fingers, until the end of the wire is completely buried beneath the entire thickness of the skin. If the skin has been drawn to one side before the insertion of the needle as suggested, the end of the wire will not remain opposite the skin puncture. This seems a small point but it is necessary in order to prevent a certain amount of irritation, and the possibility of infection extending down along the course of the wire. Pressure should be applied immediately upon the withdrawal of the needle, in order to prevent the formation of a hæmatoma due to the escape of blood into the subcutaneous tissues through the needle hole. In one of my cases, an hæmatoma formed which gave rise to a sloughing of the overlying skin and subsequent infection of the clot, and undoubtedly hastened the patient's death from hemorrhage.

The ultimate results of this operation are necessarily somewhat disappointing when one considers the small percentage of cures. Some observers insist that no cases are permanently cured. This, however, it seems to me, is too extreme a statement. A small percentage of cases have died as the immediate result of the operation. A larger percentage have died from remote results of the operation. The vast majority have been improved by it. Improvement has lasted from a few days to a term of years. A few cases, I believe, can truthfully be said to have been completely cured. A good deal, of course, depends upon what constitutes a cure.

One of my own cases, an elderly physician from the South, who suffered from an aneurism of the aorta just above the bifurcation, is a case in point. His aneurism had previously been treated by Dr. Halsted by the application of one of his bands. Unfortunately, owing to some unexplained cause, a slight infection had taken place about the band. His symptoms continuing, at Dr. Halsted's suggestion I wired the aneurism through an abdominal incision. As a result, the patient's symptoms completely disappeared as far as his aneurism was concerned, but owing to the infection about the band and to his advanced age and weakened condition, he ultimately succumbed.

Autopsy showed a complete obliteration of the aneurismal sac and the cause of death to be due to infection. Comment is unnecessary.

In several of the cases, gelatin injections were administered in addition to the wiring, with apparently good effect. In a case reported in a private communication by Jones, this was done. The patient after six years is still living and in good physical condition, but has recently noticed a recurrence of pain in the chest.

It is of the utmost importance, and I want to emphasize this fact, that these cases should be kept as nearly as possible in a state of physiological rest for a term of months after the wiring. In this way only will the best results be secured. In three of my cases, after the complete subsidence of all symptoms referable to the aneurism, the patients because of this fact, and in spite of orders to the contrary, dated the return of their trouble immediately following some unusual effort. Hirschfelder suggests that the administration of the calcium salts, after the method of Wright, both before and after this operation might be of advantage. So far as I know, this has never been done. It is worth a trial.

Of our 23 cases, so far as I know, but we have not been able to trace them all, only two are still living—one after nearly three years, the other not quite a year. Both were aneurisms of the thoracic aorta. All my cases were males, mostly young men, only two being over fifty years of age. One-half of them gave a history of lues and one who denied it had a positive Wassermann reaction. Over 25 per cent. admitted using alcohol to excess. In three instances, the trouble was of traumatic origin. In one case, the recurrence dated from a fall from a height, the patient catching himself with the hand of the affected side. This case was of special interest because I resected the greater part of the first and second portions of the sternum and the first, second, and third ribs on one side in order to expose and examine the aneurismal sac, so close was it to the heart, before daring to insert the wire.

It is an interesting fact that at first practically all of our cases were aneurisms of the abdominal aorta. In recent years, the reverse has been true and they are now almost all of the thoracic variety. The latter are more amenable to treatment by this method, owing to their greater accessibility and because a general anæsthetic is not necessary.

On the whole, the results of this operation, when one considers the absolutely hopeless condition of the patient under any other method of treatment, would seem to justify its employment in every case where it is not otherwise contra-indicated.

CASE I.—No. 740. W. T. G., male, aged twenty-seven years. Printer. Diagnosis, abdominal aneurism.

Patient entered the hospital complaining of swelling, pulsation, and pain in the abdomen. He gave a suspicious syphilitic history. He had had pain and soreness in his stomach and intestines for four or five years, but the symptoms had gotten much worse during the six months previous to admission. Pain was so severe that he was unable to lie on his back or right side, and when he walked, he had to walk with a decided stoop. Upon examination, a pulsating mass was found in the epigastrium about the size of a fist. A distinct thrill could be felt and heard over this mass. At operation by Dr. Halsted, seven inches of No. 5 silver wire were inserted into the aneurism, when it kinked. The current was run through this twelve minutes, after which the wire was cut off. At another point 38 inches of No. 4 wire were inserted and the galvanic current run through this wire for 1 hour and 25 minutes, varying from 30 to 100 ma. No change in the pulsation of the tumor was noted. The patient died 24 hours after operation from rupture of the aneurism through the diaphragm, probably due to a burn from too strong electric current.

CASE II.—No. 8050. R. E. E., male, aged twenty-five years. Bookkeeper. Diagnosis, aneurism of the superior mesenteric artery.

Patient entered the hospital complaining of pain in the abdomen. He had a suspicious syphilitic history. For about one year previous to admission he had been suffering increasing

FIG. 1.



Showing formation of clot about wire coiled in aneurismal sac.



pain of a sharp and steady character in his abdomen, so much so that he was unable to work. On examination there was found a pulsating globular mass in the epigastrium, a little to the left of the middle line, the pulsation was of an expansile character, and there was a distinct thrill. At operation August 27, 1908, the pancreas was found covering the sac and had to be dissected off of it, after which five feet of drawn silver and copper alloy wire were inserted without difficulty. The galvanic current was run through this wire for 1 hour and 20 minutes, strength varying from 30 to 70 ma. The pulsation in the tumor seemed less after the wiring and there was no thrill to be felt. Following the operation, however, the patient continued to suffer great pain and finally died 20 days later from rupture of the sac into the duodenum.

CASE III.—No. 9935. M. P., male, aged thirty years. Machine agent. Diagnosis, abdominal aneurism.

The patient entered the hospital complaining of an aneurism. He denied syphilitic infection. For about one year previous to his admission, he had been suffering intense pain in his abdomen, radiating to his back. This pain gradually became so bad that he was unable to walk 50 yards, and he had to take a great deal of morphia to get relief. Upon examination, there was a definite bulging in the epigastrium, where a distinct tumor having an expansile pulsation could be felt. A systolic and diastolic bruit could be heard over it. On January 26, 1900, nine feet of silver and copper alloy wire were introduced into the aneurismal sac and 10 ma. of current sent into it for one hour.

The patient was discharged about two months later, having obtained great relief from his pain. Otherwise, however, there was no benefit. The tumor and pulsation could still be felt.

CASE IV.—No. 10,379. H. C. P., male, aged thirty-six years. A lawyer. Diagnosis, abdominal aneurism.

Patient entered the hospital complaining of pain in the stomach, inability to sleep, and loss of appetite. He denied a luetic history. He was a rather heavy drinker. For about a year patient had been suffering from pain in the abdomen, especially on lying down. This pain gradually became so terrific that the patient was unable to sleep or eat. He was accustomed to take great quantities of laudanum. The pulsation was of an expansile character, and a systolic murmur could be heard over

the tumor. At operation 11 feet of wire were introduced into the aneurismal sac and 10 ma. of current were run through for one hour. The patient reacted well to operation, but four days later he began to have great pain and difficulty in swallowing and his pulse rose to 130. He continued in this condition for four days, when he suddenly died. No autopsy.

CASE V.—No. 11,080. R. W. F., male, aged fifty-three years. Machinist; married. Diagnosis, aneurism of the abdominal aorta.

The patient entered the hospital complaining of a full feeling in the abdomen. He had a suspicious syphilitic history. Had lost 70 pounds in three years. For six months he had suffered from palpitation, shortness of breath, and pulsation in the abdomen. He had had no pain, his appetite was good, no cough or no epigastric symptoms. Upon examination, a prominent pulsating mass was found in the epigastric region a little to the left of the median line. Pulsation was of an expansile character. No definite thrill was felt, but a systolic and diastolic thrill was clearly heard. At operation, 11 feet of silver-copper alloy wire were introduced and 10 ma. of current were run through the wire for one hour. The patient was not improved by the operation. He was discharged later at his own request.

CASE VI.—No. 11,189. J. D., male, aged thirty-four years. Carpenter. Diagnosis, abdominal aneurism.

Patient entered the hospital complaining of an abdominal aneurism. He had had a syphilitic infection. For two years the patient had suffered from pain in his back and for three months pain in his abdomen. Of late the pain had been so bad that he was unable to work and was compelled to take morphia for relief. He had himself noticed pulsation in the abdomen. Upon examination a wide area of pulsation was felt in the epigastrium a little to the left of the median line, and a systolic bruit heard. No definite tumor, however, could be made out. Ten feet of alloy wire were inserted and 10 ma. of current were run in for 1 hour and 15 minutes. Operation was performed November 16, 1900. Fifteen days later the patient suddenly began to have extreme pain in his back, accompanied by nausea and vomiting, and died.

CASE VII.—No. 14,053. A. B., male, aged forty-three years. Married; a pilot. Diagnosis, abdominal aneurism.

The patient entered the hospital complaining of pain in his abdomen. He had always been a heavy drinker. He denied syphilis. For five years he had had a sharp stinging pain about the umbilicus. Five weeks before admission this had become so bad that he had to stop work. Upon examination there was a pulsation which could be seen and felt all over the abdomen, but in the epigastrium a definite mass having an expansile pulsation could be felt. There was a systolic shock and thrill. At operation, November 14, 1902, 11 feet of wire were inserted and 10 ma. of current run through this wire for one hour. Patient complained of violent pains throughout the entire operation. Following operation, there was no improvement in the condition except possibly that the tumor could not be as readily grasped and the pulsation seemed less than before operation. He was discharged at his own request one month after operation somewhat improved.

CASE VIII.—No. 21,248. A. T. Van H., male, aged forty-six years. Married; mechanical engineer. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of pain in his chest. He had had syphilis. He had been a moderate drinker but a very hard worker. For two years he had had sharp pain near the centre of his chest. He had also had an intermittent cough but no expectoration. The pain extended to his back and down the arms, and was so severe that he was unable to lie down on his left side. No shortness of breath and no difficulty in swallowing. Upon examination there was a distinct precordial bulging or heaving and a very definite pulsation, being especially marked at the fifth right interspace near the sternum, where a diastolic shock could be felt. There was no thrill. The patient had a definite tracheal tug. At operation, September 13, 1907, three-fourths of the sternum and the end of the right clavicle were resected together with the costal cartilages of the first four ribs on the right side. Eleven feet of wire were inserted into the aneurismal sac and 10 ma. of current run into it for 50 minutes. Three weeks after the operation the patient was discharged practically well. The area of the heaving and pulsation was considerably diminished, and the patient had practically no pain.

On June 29, 1908, patient was re-admitted. He had been at work ever since two weeks after his previous discharge. He

was all right until April 1, 1908, when he slipped while on a scaffolding, and to prevent himself from falling he grasped hold of a piece of timber with his left hand, injuring his chest severely. Soon after this he noticed a swelling over his chest. No dysphagia, no dyspnœa, and very little pain. Upon examination, to the right of the median line at the second interspace there was a small conical swelling which had an expansile pulsation, and over which a diastolic shock could be felt. Twelve feet of wire were inserted into the aneurismal sac and a current varying from 10 to 40 ma. was run through the wire for one hour.

One month later he was discharged in excellent condition, the tumor was smaller, no dyspnœa, and no dysphagia. He died some months later from rupture of the sac.

CASE IX.—No. 21,650. B. T. H., male, aged forty-three years. A customs inspector. Diagnosis, thoracic aneurism.

Patient entered the hospital complaining of an aneurism. He had had syphilis. For several years he had had a sharp pain under his right sternum. This pain radiated into his right shoulder and the right side of his neck, also under his right scapula. There was considerable difficulty in talking and swallowing but no dyspnœa. Upon examination a round prominence, 7 cm. in diameter, was found in the second right interspace. There was a definite expansile pulsation and systolic and diastolic murmur. December 6, 1907, 11 feet of wire were inserted into the aneurismal sac and a 10 ma. current was run in for one hour. The patient showed no marked improvement, and on March 7, 1908, the aneurism was wired again. Eleven feet of wire were inserted and 10-14 ma. run through for 20 minutes. Six weeks later the patient was discharged improved. The tumor still remained, but the pulsation was less. Systolic and diastolic thrill were still felt. There was no pain and the patient felt very well.

CASE X.—No. 22,027. H. L., male, aged thirty-nine years. Married; farmer. Diagnosis, thoracic aneurism.

Patient complained of pain in the right chest and right arm. He denied syphilis. About a year and a half previous to admission he was kicked in the chest by a mule, and suffered great pain here and in the right shoulder and arm ever since. Four months after the injury he noticed a pulsation in the right upper chest. This has become more marked, and there have been sharp pains in the chest and left scapula so that he has been unable to

walk. Upon examination there was a marked pulsation in the second right interspace, over which a systolic murmur could be heard and a heave could be seen and felt. There was no tracheal tug. Upon fluoroscopic examination by Dr. Baetjer a sacculated aneurism was made out. On March 3, 1908, 11 feet of wire were inserted into the aneurismal sac and for one hour a current varying from 10-20 ma. was run in. The patient improved after the operation but developed a left hydrothorax, for which he had to be tapped several times. He was discharged three months after operation in fairly good condition. There was, however, a marked systolic pulsation in the first and second right interspaces and a heaving impulse over the rest. There was no pain.

CASE XI.—No. 23,359. J. S., male, aged twenty-five years. Blacksmith. Diagnosis, thoracic aneurism.

Patient entered the hospital complaining of palpitation of the heart. He denied all venereal infection. About one year previous to admission, while lifting a heavy wagon, he was seized with a violent pain in his left shoulder which radiated down his left arm. This was accompanied by severe palpitation of the heart. Since that time the pain has continued and the patient has been troubled a great deal with palpitation, shortness of breath on exertion, a dry cough, and inability to sleep. Upon examination there was a bulging of the whole left chest, and on palpation of the second and third interspaces, a pulsation of a rather expansile character could be made out. Over this area there was great tenderness. A systolic and diastolic thrill could be felt. On December 18, 1909, 12 feet of wire were inserted into the sac, and for one hour the current varying from 10-40 ma. was run through the wire. The patient was discharged four months following the operation in good condition. The heave and pulsation could still be felt in the left chest, and the bulging was still present together with the systolic and diastolic murmur, but the pulsation was considerably diminished and the pain had entirely disappeared.

CASE XII.—No. 23,652. Dr. S. M. O., male, aged sixty-eight years. Diagnosis, abdominal aneurism.

The patient entered the hospital complaining of colic-like pain in the abdomen. He denied all venereal infection. He had been losing weight for several years, and of late had been suffering pain in the abdomen. This became so severe that morphia

was necessary to obtain relief. Six months previous to admission he noticed a mass in the epigastrium which was quite tender. He was a heavy drinker and smoker, and had lost 60 to 70 pounds. On February 23, 1909, Dr. Halsted put one of his aluminum bands on the aorta just above the renals. Following this there was for a time a decrease in the size of the tumor. Gradually, however, the aneurism began to increase in size and the pain became so terrific that wiring was advised. On March 12, 1909, therefore, 11 feet of wire were inserted into the aneurismal sac, and for one hour a current varying from 10-40 ma. was sent into the sac. The patient was not improved by the operation and gradually lost ground, until death ensued seven weeks after the first operation and four weeks after the second operation.

At autopsy an abscess was found in the right ileopsoas muscle, originating about the band. (There was a sacculated aneurism, inside of which around the wire there was a beautifully healed organized clot. The patient had died of an infection.)

CASE XIII.—No. 25,784. J. B., male, aged forty-eight years. Married; laborer. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of tumor in the chest. He had had a suspicious syphilitic history. He was a rather heavy drinker. For four months previous to admission he suffered from pain in the right side of his head so that he could not work. His voice became hoarse, and he was troubled with a cough and bloody sputum. He occasionally had pain in the right chest, shortness of breath, and orthopnoea. Upon examination there was found a great bulging in the right upper chest, wide area of pulsation to the right of the sternum, pulsation being of an expansile character. There was a faint systolic thrill to be heard, no tracheal tug. May 6, 1910, 11 feet of wire were inserted into the aneurismal sac, and for one hour a current varying from 10-40 ma. was sent through the wire. Three weeks later the patient was discharged subjectively markedly improved, but the condition in the chest was about the same.

The patient died November 2, 1911. (Personal letter from his wife.)

CASE XIV.—No. 25,816. H. L., male, aged thirty-six years. Married; laborer. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of pain in the

right side. Denied all venereal infection. For three and a half months he had had a cramp-like pain in the right chest, so much so that he was unable to work and unable to sleep. He had a slight cough. Upon examination there was a visible pulsation in the second right interspace, where a forcible heaving impulse and faint thrill could be felt. There was a diastolic and systolic murmur to be heard, and a definite tracheal tug was present. The Wassermann reaction was positive. On April 22, 1910, 12 feet of wire were inserted into the aneurismal sac, and for one hour a current varying from 10-40 ma. was run through the wire. The patient was discharged three weeks later much improved. No more pain, but the pulsation in the chest was about the same.

CASE XV.—No. 25,817. E. G., male, aged forty-eight years. Laborer. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of pain and swelling in the chest. He had had a syphilitic infection and was a hard drinker. For seven months previous to admission following the lifting of a heavy weight, the patient became suddenly very weak. Since then he has had dizzy spells and a dull pain in the upper right chest and arm, especially at night. For one month he had noticed a swelling in the right chest, which has been getting larger. His Wassermann reaction was positive. Upon examination there was a pronounced bulging tumor having an expansile pulsation about the size of a small lemon to be seen in the second and third right interspaces. There was a systolic and diastolic thrill. On April 22, 1910, 11 feet of wire were inserted into the aneurismal sac, and for one hour a current varying from 10-40 ma. was sent through the wire. For a time the tumor, pulsation, and pain had decreased, but just before discharge, four months after operation, the tumor began to increase in size and again the patient began to suffer pain and considerable dyspnœa.

CASE XVI.—No. 26,914. Dr. M. W., male, aged thirty-seven years. Single. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of an aneurism. He had had a syphilitic infection. He was a moderate user of alcohol and tobacco. For four years he had been a great sufferer from angina pectoris. In 1908 he noted a pulsation in the second left interspace, following which he had sharp pain in the left

chest, radiating down into his back and shoulder. Morphia was necessary to obtain relief. In 1910 a definite bulge in the region of the left third rib was noted; this increased slowly and the pain became a great deal worse. Upon examination there was a bulging swelling in the left upper chest between the first and third ribs, the pulsation being of an expansile character. There was a systolic and diastolic thrill. On November 18, 1910, 12 feet of wire were inserted into the aneurismal sac, and for one hour a current varying from 10-40 ma. was run through the aneurism. The patient was discharged four and a half months after operation greatly improved, both subjectively and objectively, and from a personal letter the patient said that he is now enjoying fairly good health (December, 1911).

CASE XVII.—Nos. 27,272 and 27,758. F. G. J., male, aged thirty-six years. Married; salesman. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of pain in the left chest and a tumor. He had a suspicious syphilitic history. He had always been a hard drinker. About two years previous to admission he began to have a dull ache in the left chest, worse at night. One year after this he noticed a change in his voice, he became easily exhausted and short of breath on exertion. A peculiar brassy cough developed shortly after this, with swelling in the left chest which also increased steadily in size. All his symptoms became gradually worse, especially the pain which radiated down to his left arm. Upon examination there was a heave to the whole upper chest to the left of the sternum. In the second interspace there was a definite pulsation and swelling, the pulsation being of an expansile character. There was a systolic and diastolic thrill to be made out. On January 29, 1911, 10 feet of wire were inserted into the aneurism, and for one hour a current varying from 10-40 ma. was run through the wire. One month later he was discharged in good condition. He had almost no pain. His voice was still husky, but the cough was relieved.

On May 4, 1911, the patient was re-admitted. He said that following his discharge he continued to improve until, one week previous to his second admission, after no unusual exertion, he noticed a dull pain in the left chest about the position of the old aneurism. Following this he noticed a prominence in this

area and a pulsation. There was no pain or discomfort. Upon examination there was a definite pulsating tumor in the third left interspace.

There was no pulsation in the back. A tracheal tug was present but not especially marked. On May 8, 1911, the aneurism was wired again. Ten feet of wire were inserted and the current run through from 10-40 ma. for one hour. Following this operation the pulsating tumor seemed to become solid and the pain disappeared. On June 4, 1911, however, after having been up and about for several days, the aneurism suddenly grew larger and caused great pain. Its diameter became 12 cm., whereas before this it was 5 cm. The skin over it was red and tender, and the patient's temperature was 102° . On June 6, the aneurism was wired again. The idea of this operation was to block pressure from below and to strengthen the anterior wall of the sac which had apparently given way. The needle was, therefore, passed into the aneurismal sac on a slant and the wire wound on a smaller spool than usual in order to get a smaller curve. As in the previous wiring, the needle apparently passed through a thick clot before the sac of the aneurism was entered, and after two feet of the wire had gone in with comparative ease it seemed to block and the operator felt that the wire probably twisted on itself, for after a little pressure a new start was given and another foot or two passed in easily. This performance was repeated several times until finally it was impossible to pass in any more wire, about nine feet having been inserted. The current was then run in as in the previous operation. The operation was done in the ward and the patient did not have to be lifted from his bed.

Four days later, June 10, 1911, the aneurism was very firm and there was only a slight pulsation. There was considerable pain, however. The temperature was normal. On June 20 there was no expansile pulsation, very little pain, and slight infection over the aneurism, however, broke through the skin.

On July 13 the patient was up in a chair and seemed in good condition generally. He was discharged on July 17, 1911, able to get about.

CASE XVIII.—No. 27,285. G. B., male, aged forty-four years. Laborer; single. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of pain in his

right chest. He denied all venereal infection. He had always been a hard worker, had used alcohol moderately. He had had pain in the upper right chest for two and a half months, worse at night, which was of a sharp and shooting character. It sometimes radiated down the arm, shoulder, and the neck. He had some dyspnoea. His symptoms had become worse just before admission. Upon examination there was a systolic heave to the manubrium and the right upper chest. There was a localized pulsation in the first right interspace where a systolic pulsation and thrill was felt together with a diastolic shock. There was a systolic and diastolic murmur over the heart. His Wassermann was negative. On February 6, 1911, 11 feet of wire were passed into the aneurismal sac and the galvanic current run in from 10-40 ma. for one hour. There was marked diminution in the pulsation, and the pain had almost disappeared on February 17. February 24 the patient was discharged in good condition.

CASE XIX.—Nos. 27,915 and 27,966. H. H. H., male, aged thirty-five years. Married; electrician. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of an aneurism. He had had a urethritis but denied syphilis, and there were no secondaries. His Wassermann was negative. He had been a steady drinker for three years, and had used a good deal of tobacco. He had had pain in the upper left chest for nine months. This pain later on went over to his right upper chest and down his right arm. He had suffered from shortness of breath and palpitation of the heart, but his chief complaint was the constant pain which necessitated great quantities of morphia. This pain radiated into his right arm, back, and shoulder. Upon examination there was a pulsating tumor in the right upper chest, most marked in the third right interspace. The pulsation had an expansile character, and a to and fro murmur could be heard over it. On fluoroscopic examination by Dr. Baetjer a pulsating mass could be seen behind the sternum rather high up. There was some bulging to the right. On June 14, 1911, 11 feet of wire were passed into the sac, and 20 ma. of current were sent into it for one hour. The patient was unable to stand more than 20 ma. On June 20 there was definitely less pulsation and no pain. On June 27 the patient was discharged much improved.

CASE XX.—No. 28,689. G. W., aged twenty-seven years. Laborer. Diagnosis, thoracic aneurism.

The patient entered the hospital complaining of shortness of breath. He had had syphilis in 1908, and had been a heavy drinker. For 19 months he had had pain in his chest. One month after the pain began he became hoarse, and five months after the pain began he became dyspnœic and had palpitation of the heart. The pain radiated to his shoulder and right arm. He had had a cough since the onset. All his symptoms gradually became worse. Upon examination there was a prominence of the second and third left costal cartilages. Near the sternum there was a definite pulsation to be seen. No shock but a soft diastolic blow could be heard over the area. The left arterial pulse was delayed. There was a definite tracheal tug. On November 3, 1911, 11 feet of wire were passed into the sac. No spurt of blood followed the introduction of the needle as is usual. It felt as if the wire were passing through a soft clot. After the introduction of a considerable amount of wiring, the usual sudden pulsating stream of blood appeared, and it was evident that the wire had entered the sac. A current of from 10-40 ma. was passed through the wire for one hour.

On November 9 he began to complain of great pain in his right breast. His abdominal muscles became rigid. This condition continued and a few days later grew considerably worse, so that great quantities of morphia were necessary to relieve him. He became dyspnœic. Nothing definite, however, could be made out upon examination. He finally died.

At autopsy the anatomical diagnosis was aneurism of the descending aorta, multiple aneurisms of the thoracic and abdominal aorta; complete thrombosis of the superior mesenteric aorta with collateral circulation established; aneurism of the right renal artery with a mural thrombosis; abscess in the subcutaneous tissue around the wire; aortic insufficiency and bronchopneumonia. Numerous strands of wire extended down throughout the thoracic and abdominal aorta to the orifice of the renal arteries. Thromboid masses were adherent to the wire throughout its course. A loosely adherent thrombus was found at the bifurcation of the iliac arteries. There were three definite aneurisms of the aorta—the one which was wired in the ascending aorta, another in the descending aorta, and a third just below the cœliac axis. The immediate cause of death in this case was probably bronchopneumonia.

CASE OF DOCTORS C. L. JONES AND C. S. HAMILTON, of Columbus, Ohio (personal communication).

L. R. T., aged 48 years, male. Diagnosis, thoracic aneurism. The patient entered the hospital complaining of pain in the chest and back. He denied all venereal infection. He had always been a hard drinker, has drunk a good deal of beer and wine. On June 16, 1905, he was thrown from a street car, and being picked up unconscious was carried to the hospital. Ever since that injury he has suffered great pain in his chest. It was not very severe at first, but later increased in severity and radiated from his right chest to the back between the shoulder-blades. He finally became so uncomfortable that he was unable to sleep in a recumbent position. He suffered greatly from shortness of breath and became dizzy on slight exertion. His voice became husky and he developed a dry cough. Upon examination a heaving impulse could be felt to the right of the sternum, most marked in the second interspace. No thrill could be felt. A tracheal tug was present. No murmurs could be heard over the site of the aneurism. Blood-pressure was 132. On February 24, 1905, 19 feet of silver alloy wire were passed into the aneurismal sac and the current was run in for one hour, varying in intensity up to 20 ma. Following the operation all pain ceased. Pulsation in the chest was distinctly less, and the shortness of breath gradually disappeared. The patient left the hospital 20 days after the operation in good condition and has remained so up to within about a month ago, when his old pain recurred. At present he is living in Denver and is considering being rewired.

CASE OF DR. JOSEPH R. EASTMAN (*N. Y. Med. Journal*, December 15, 1906).

The patient was a male, aged 41 years. Waiter. He denied all venereal history, but he was a heavy drinker of beer and whiskey and was a heavy smoker. About six months before admission to the hospital he noticed a pain in the left side above the cardiac region. This pain was sharp and shooting in character and so severe as to almost cause him to fall. It radiated through the shoulder to the posterior scapular region and became continually worse. He coughed only during the last week before admission. At times his voice was almost completely lost. Upon examination there was a large area of distinct heaving pulsation above the left nipple. There was an expansive pulsation in the fifth right interspace and a distinct bulging above the left nipple. There was an oval palpable tumor one and a half inches in diameter above the left nipple line upon the second and third ribs and second interspace. No bruit could be heard over the tumor. On February 13, 1906, 15 feet of No. 28 silver wire were inserted into the cavity of the aneurism. After the introduction of the wire the pain became worse, and three weeks later five feet of the wire were removed. Orthopnea developed and gradually became worse. The left chest became filled with a serosanguineous fluid, which was drawn off one month after the operation.

The patient died suddenly on May 4, 1906, with a profuse hemorrhage at the mouth.

At autopsy there was found a large aneurism just above the heart, which through pressure had ruptured into the trachea. At the conclusion of this article, there is a note which reads, "Galvanism was not employed after the introduction of the wire for the reason that the dangerous condition of the patient forbade it."

CASE OF DOCTORS J. M. ANDERS AND J. P. MANN (*Transactions of the College of Physicians, Philadelphia, 1908, volume xxx*).

The patient was a colored man aged 36 years. He entered the hospital complaining of a painful throbbing lump in his chest. He had had syphilis, but claims the primary sore had appeared only four months previous to his admission. He had always been a heavy drinker. Four years previous to his admission he noticed a dull boring pain under the sternum. Soon a small painful throbbing protuberance appeared to the right of the midsternal region. He had at times suffered from a severe cough, marked dyspnœa, and general weakness. Four days prior to admission, during a "spree," he suddenly felt a sharp pain accompanied by a sense of something giving way in the chest. This was attended with a smothering sensation, and at the same time, he noticed that the tumor became rapidly larger. On examination, there was a conical tumor mass projecting from the thorax at the right edge of the sternum. It was about two and a half inches in height and three inches in diameter at the base. There was a definite expansile pulsation to be felt, and a systolic murmur to be heard over this tumor. On January 29, 10 yards of fine silver and copper wire were inserted into the aneurismal sac. Almost immediately the expansile pulsation was markedly diminished and the tumor mass was less prominent. About two weeks later an additional slight elevation above the second right rib was visible. This also gave an expansile pulsation and slowly increased in size, so that on February 13 several yards of fine silver wire were inserted into this. On February 28 the entire surface of the primary tumor mass sloughed off, exposing the wire coiled up within the aneurismal sac. Following this there was a slight oozing of blood occasionally to be seen, but the wound gradually healed by granulation. The patient gradually recovered his strength, and the tumor mass, which was wired, showed only very slight pulsation. On March 10, 1908, the patient was in good condition. (Apparently no current was used in this case at all.)

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A FURTHER CONSIDERATION OF AN OPERATION FOR POTT'S DISEASE OF THE SPINE.

WITH REPORT OF CASES FROM THE SERVICE OF THE NEW YORK ORTHOPÆDIC
HOSPITAL.

BY RUSSELL A. HIBBS, M.D.,
OF NEW YORK.

ON May 27, 1911, I published¹ a preliminary report of three cases of Pott's disease of the spine, which had been subjected to an operation for the purpose of producing a fusion of the posterior aspects of the vertebræ, to obliterate motion of the vertebral articulations over the diseased area and to relieve pressure on the involved bodies, thereby hastening the cure of the disease and preventing deformity.

In one case only had a sufficient length of time elapsed on the date of the above-quoted publication to make possible the demonstration of a fusion by X-ray picture. At the present writing an equally positive demonstration has been given by the same test in the other two cases previously reported.

Further, in all three instances the strength and functional sufficiency of the new and continuous bone splint covering the affected vertebral area has been abundantly demonstrated by the use to which it has been subjected. The three cases have been without external support long enough to justify the conviction, not only that fusion has taken place but that it has obliterated motion over the operative field, prevented any increase of deformity, and eliminated all symptoms of disease.

The operation was suggested to me by my experience in the use of an operation involving practically the same principles, for stiffening the knee-joint by mortising the patella into the joint after it was denuded of periosteum.² The patella periosteum was carefully preserved and sutured to the periosteum of the femur above and to that of the tibia below. In these

cases continuous bone was produced between the femur and the tibia, obliterating the joint.

I thought that in the spine the careful removal of the periosteum of the spinous processes and the laminae, with the spinous processes transposed to bridge the gap between the vertebrae, would lead to formation of bone, fusing the vertebrae, and eliminating motion between them.

It is important to observe that in the case of the spine, the gap to be bridged between the laminae and the spinous processes of any two adjacent vertebrae is very narrow. Fig. 1 is a photograph of a dried preparation of the vertebral column and ligaments showing the narrow gaps very plainly.

In performing the operation, a longitudinal incision is made directly over the spinous processes, through skin, supraspinous ligament, and periosteum, to the tips of the spinous processes. The periosteum is split over both the upper and lower borders of the spinous processes and the laminae, and stripped from them to the base of the transverse processes.

Fig. 2 is a drawing made from a dissection which shows the periosteum retracted and the spinous processes transposed.

Fig. 3 is a lateral view of the transposed spinous processes.

The lateral walls of periosteum and of the split supraspinous ligament are brought together over these processes by interrupted chromic catgut sutures. The skin wound is closed by silk, and a steel brace applied with the space between the uprights increased somewhat at the site of the wound so as not to make pressure upon it.

Rest in bed is absolute for eight weeks. During the next four weeks sitting up is permitted. At the end of the twelfth week walking is allowed.

The brace is continued for another month, when it is removed for a part of each day until gradually left off entirely.

CASE I.—Edward Q., age nine years. Lumbar Pott's disease of three years' duration. Moderate kyphos. Almost complete destruction of bodies of the second and third lumbar vertebrae. Disease active.

Operation (January 9, 1911).—The operation included the last dorsal and three upper lumbar vertebræ, the spinous processes and the periosteum of the laminae as far as the base of the transverse processes being used in establishing the line of new bone formation.

Fig. 4 is a photograph of the boy before operation. Fig. 5 shows him 15 months after operation, or 12 months after all treatment was discontinued. Fig. 6 is an X-ray of this case taken by Dr. Caldwell of New York, three months after operation, and shows unmistakably the continuous bone formation over the operative field.

This boy has lived a perfectly unrestrained normal life without any form of external support for 12 months, and there has been no symptom indicating activity of the disease and no increase of deformity.

CASE II.—William M., age seven years. Lumbar Pott's disease of two years' duration. Very extensive destruction of the bodies of the three upper lumbar vertebræ. Moderate kyphos. Flexion deformity of both thighs from psoas contraction of 60 degrees. Fluctuating mass in both iliac fossæ.

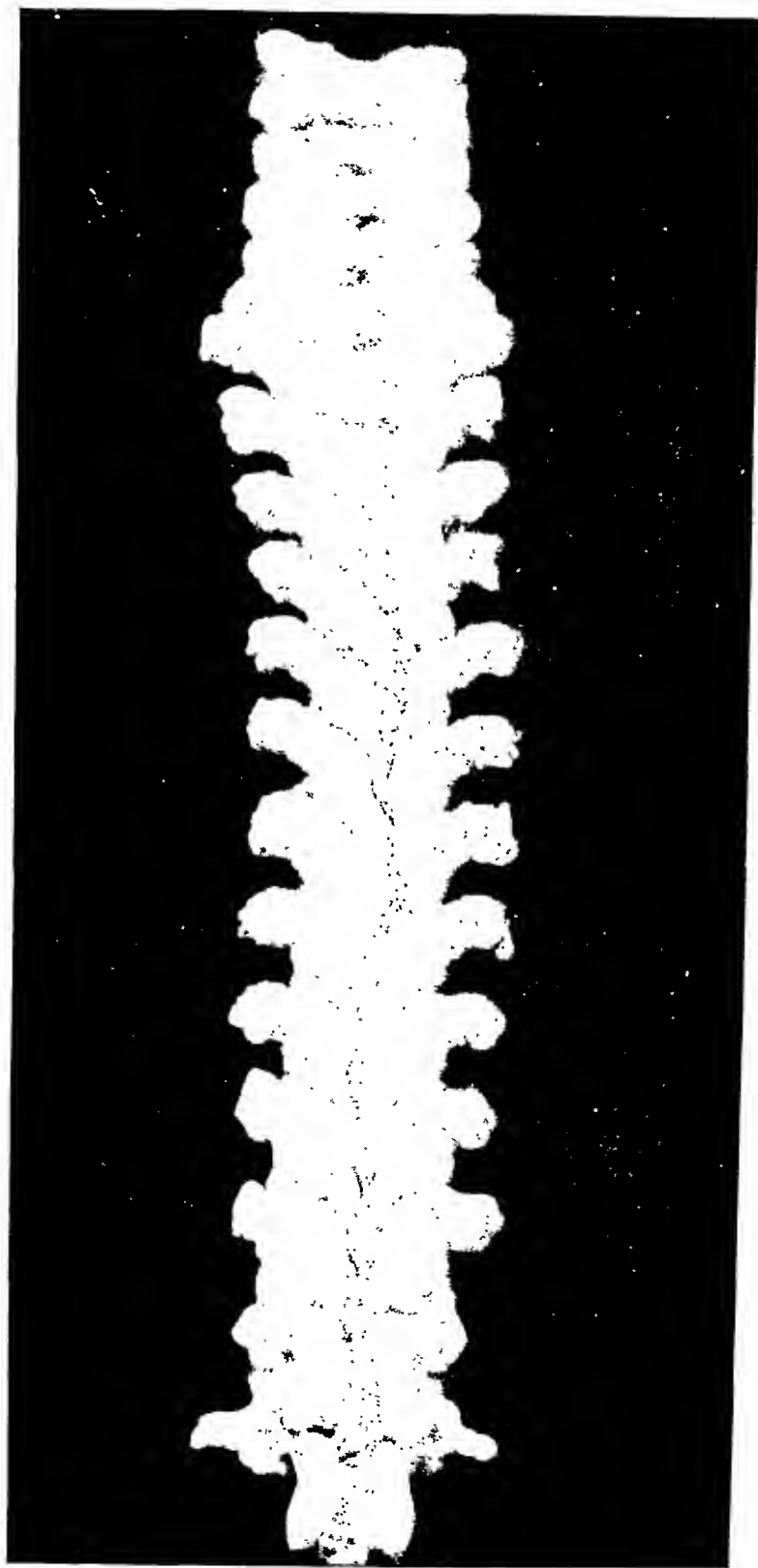
Operation (April 26, 1911).—The operation included the tenth dorsal to the fourth lumbar vertebræ. Fig. 7 is a photograph of the boy before operation, Fig. 8 eleven months after operation, and Fig. 9 is an X-ray which shows the continuous bone formation. He has been without support for eight months and there is no symptom indicating activity of disease, nor has there been any increase of deformity.

There is still, however, some psoas contraction which I believe is due to positive shortening of the muscle, as the flexion of his thighs, which was present at the time of operation, had existed for over a year.

CASE III.—Mrs. B., age twenty-five years. Married, two children. Dorsolumbar disease. Marked kyphos from the ninth dorsal to the second lumbar. Disease very active. A large fluctuating mass, left side, extending from the lower border of the ribs, down under Poupart's ligament for six inches on the anterior aspect of the thigh.

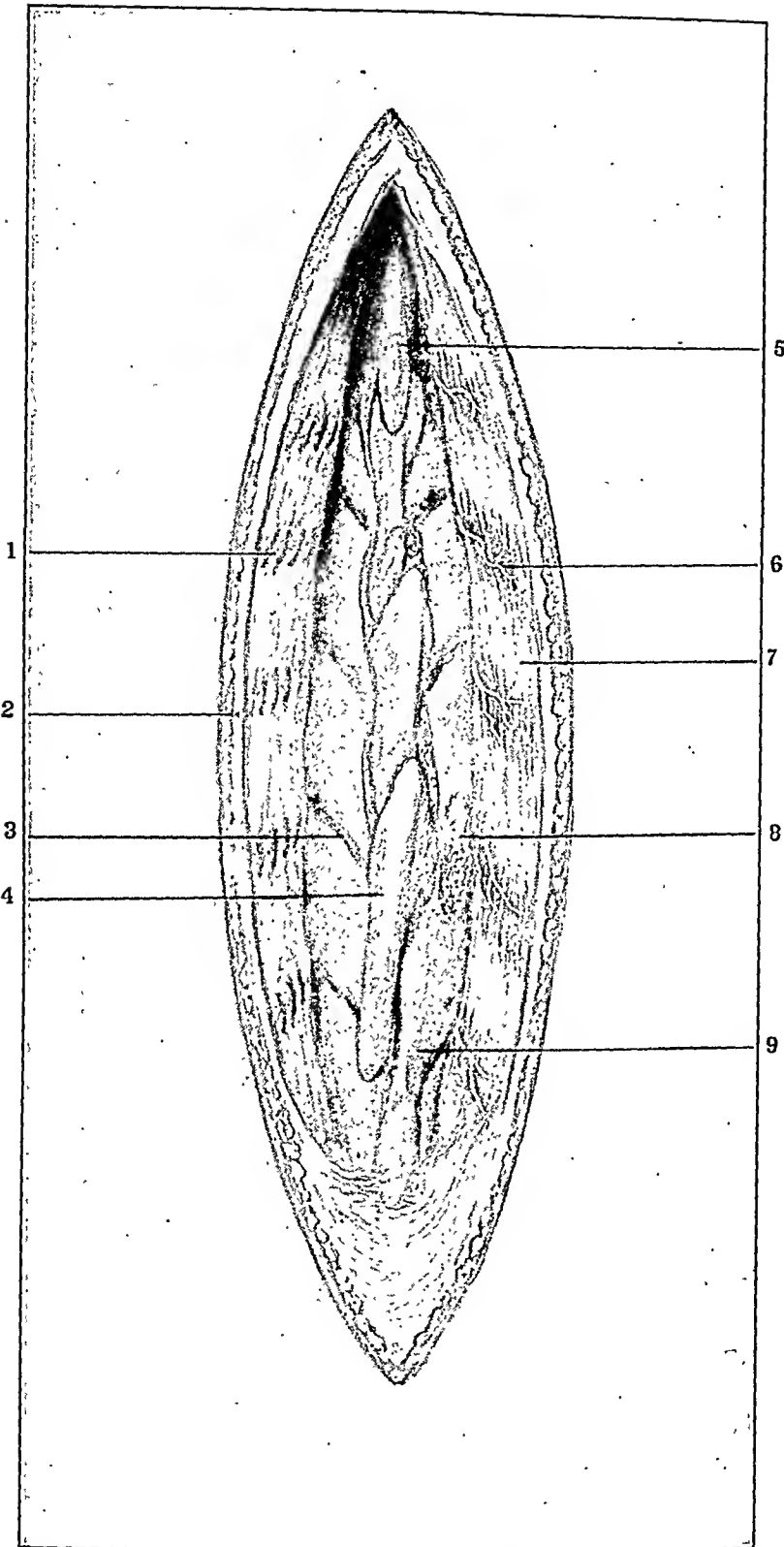
Operation (April 27, 1911).—The operation included the last four dorsal and three upper lumbar vertebræ. A few weeks after operation the abscess was aspirated and has never returned.

FIG. 1.



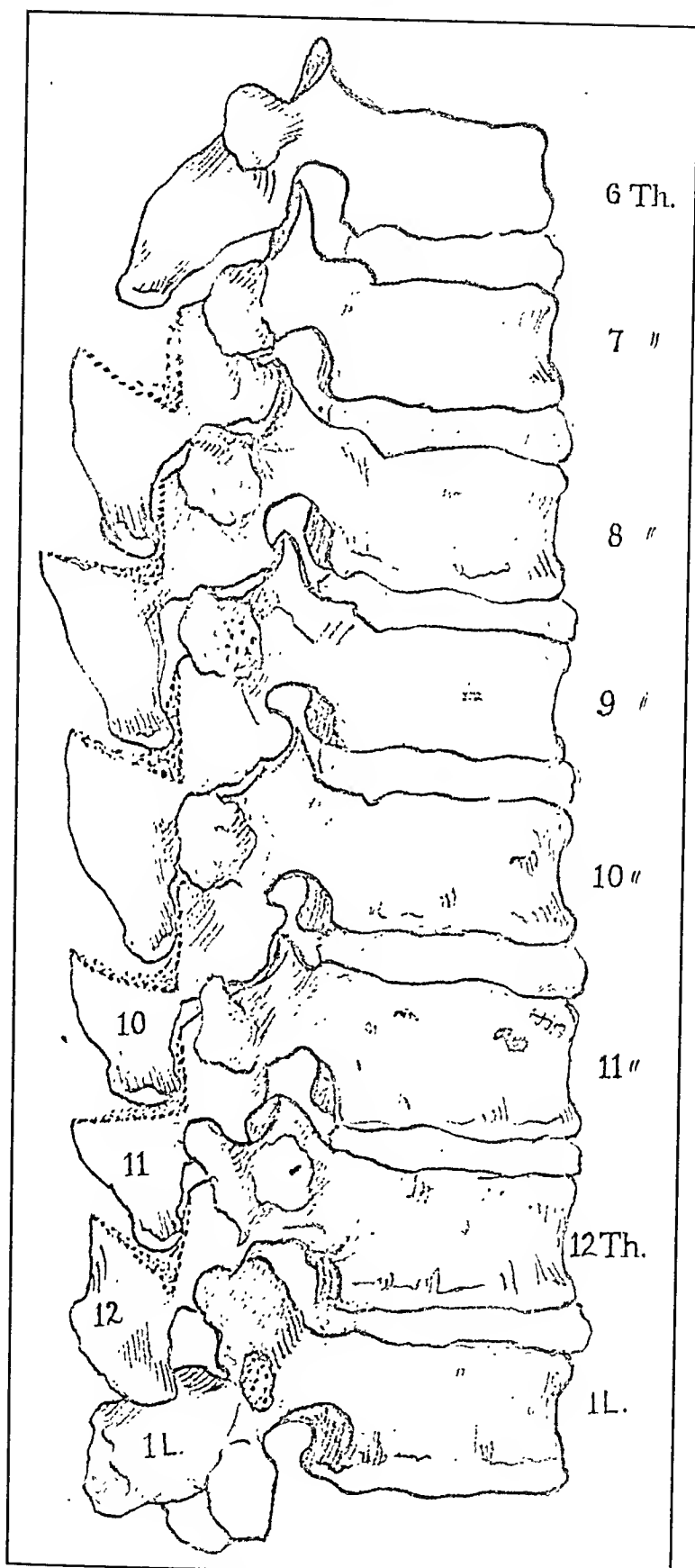
Photograph of a dried preparation of the vertebral column and ligaments.

FIG. 2.



1, shows periosteum sutured; 2, half of supraspinous ligament; 3, space between the adjacent edges of the laminae; 4, a spinous process transposed by partial fracture, making contact with its own base and the tip with the unbroken spinous process below it; 5, a spinous process marking the upper end of bridge; 6, space between the periosteum when removed from spinous processes and laminae as it appears before suture; 7, periosteum from spinous processes and laminae; 8, a small strip of bone elevated from laminae placed transversely across gap, its free end making contact with the lamina adjacent; 9, spinous process unbroken, marking the lower end of the bridge

FIG. 3.



Spinous processes partially fractured and used for bridging the gap between the vertebræ.

FIG. 4.



Photograph of Case I before operation.

FIG. 5.



Photograph of Case I fifteen months after operation and twelve months after removal of brace.

FIG. 6.



X-ray of Case I three months after operation.

FIG. 7.



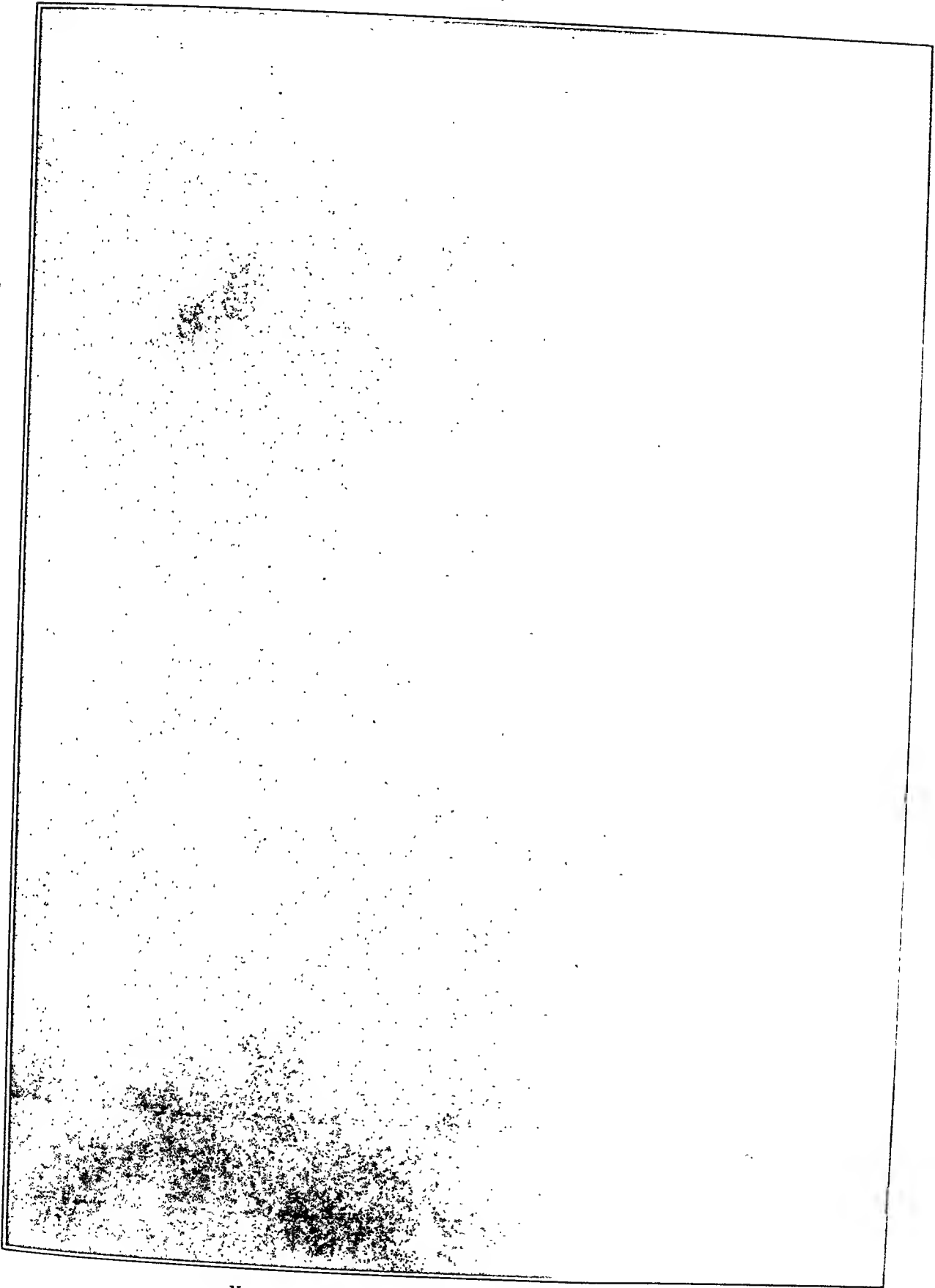
Photograph of Case II before operation.

FIG. 8.



Photograph of Case II eleven months after operation.

FIG. 9.



X-ray of Case II showing continuous bone formation.

FIG. 10.



Photograph of Case III before operation.

FIG. 11.



Photograph of Case III eleven months after operation and eight months after removal of brace.

Fig. 10 is a photograph of the patient before operation, and Fig. 11 eleven months after operation.

The very great reduction of her deformity is obvious from these photographs. The X-ray picture taken by Dr. Caldwell, while it shows unmistakably a continuous bone formation, is not sufficiently clear for reproduction on account of the stoutness of the subject. In any case the adequacy of her support is unmistakable, as for eight months she has been without any brace and has lived a perfectly normal life. There has been no symptom indicating activity of her disease and no increase of deformity.

The number of vertebræ in each instance included in the operation is determined by the extent of the disease. It is necessary always to be sure of attaching the diseased vertebræ at either end of the involved area to healthy ones above and below. The extent of the disease may be determined accurately in some cases by X-ray pictures. When this is not possible, the only guide is the kyphos or the region of rigidity.

It is a fact that all the vertebræ involved in the kyphos are not diseased, and that inaccuracy in the number of vertebræ to be operated on is possible. But care should be taken to include a sufficient number, as otherwise the elimination of motion of the diseased joints will not be obtained.

The stiffening of a small segment of the spine in a given case is not a serious matter, in view of the fact that the remaining healthy joints compensate for the loss of function of the few. Indeed is it not a fact that comparatively few cases of Pott's disease recover, with movable joints?

A striking illustration of this is Case III, a woman of twenty-five. While six vertebræ were included in the operation, thus stiffening a long segment of her spine, the spine above and below the field of operation allows such freedom of motion that she shows almost no awkwardness.

In these three patients no attempt was made to close the narrow gaps in the periosteum laterally, as is shown in Fig. 2. In many cases since I have closed these gaps, thus establishing at once continuous periosteum on either side which is sutured together in the middle.

The small space between the laminae with the gap between the spinous processes filled by their transposition makes me doubt the necessity of thus suturing the periosteum, as I think it becomes continuous and that a fusion of the laminae and spinous processes of the vertebrae operated on takes place. Certainly the result in these three cases was satisfactory. However the practice of this part of the technic is not difficult.

There are two other features of the technic that have been practised in a number of the cases which seem worthy of emphasis. One is pushing back the periosteum from the adjacent edges of the laminae to their ventral side, after its removal from their posterior surfaces. This can be done easily with a thin blunt periosteal elevator, without injury to the membrane of the cord. The other is the elevation of a small piece of bone from the laminae, placing it transversely across the space between them, its free end in contact with the lamina next below, which establishes a bone bridge (Fig. 2).

It has long been the accepted theory that the osteoblast was generated from the periosteum, and for that reason great care has been exercised to remove it without injury.

However, Macewen's³ experimental studies of bone growth seem to prove that the osteoblast emanates from the bone. Whether it is generated from periosteum or from the bone, or from both, is a question which need not be determined in estimating the value of the surgical procedure under discussion. We have both structures here in abundance, the operation stimulates the generation of the osteoblast, provides a place for its deposit and nutrition between the periosteum and bone, establishes ideal conditions for bone development, insures its continuous formation along the posterior aspect of the vertebrae operated, and produces a fusion of laminae and spinous processes from the transverse processes of one to those of the other side, thus giving a perfectly symmetrical, extensive, and adequate support.

My experience of the beneficial effects of immobilization,

even when imperfectly obtained by braces and casts, on tubercular disease of vertebral and other articulations, justifies me in believing that a more perfect degree of such immobilization, produced by bony anchorage of the diseased structures in the desired position, will unquestionably be of the greatest help in arresting and controlling the morbid processes, and will rapidly lead to a radical cure of the disease.

From the results in these three patients, I have felt justified in continuing this work and have operated on 33 other patients, making a total of 36—21 in the dorsal, 4 in the lumbar, and 11 in the dorsolumbar region.

Twenty-one were from 3 to 10, 13 from 10 to 15, one 18, and one 25 years of age. The duration of the disease has varied from three months to ten years, in the large percentage under five.

In all, the wounds have healed without complication, pain has been slight, and there has been no reaction from the operation. Eighteen of the cases have been without support from three to seven months, and have shown no symptoms of disease or any increase of deformity.

While it is too early to make a final report on these cases, one other observation has been made in connection with this operative experience, which is of very significant importance. The fact that in six cases, or nearly 17 per cent., a fusion of the laminae and the spinous processes of two or more vertebræ involved in the kyphos was found.

Five of these cases were under ten years of age, one was sixteen, at the time of operation. The duration of the disease in one was only two years, in four under four years, and in one ten years.

In all six cases the fusion was of vertebræ in the lower segment of the kyphos, in two of three vertebræ, and in four of two vertebræ, but in none was the fusion complete in producing anchorage of the diseased vertebræ to healthy ones both below and above.

The attempt on the part of nature to eliminate motion of these diseased joints by extraordinary bone growth, though

it was incomplete, is very important, as it indicates the principles which should guide the surgeon in attempting to produce this result by operation, and suggests that the procedure herein described, which preserves all the structures essential to the development of bone and stimulates their activity, is consistent with those principles.

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THE CLINICAL FEATURES AND TREATMENT OF ACUTE PERFORATING GASTRIC AND DUODENAL ULCER.

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AND

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(Continued from page 569)

The suggested advantages of gastro-enterostomy are also those of jejunostomy advocated by Von Eiselsberg,¹¹⁵ except for the fact that while the benefit of a jejunostomy consists only in permitting the early resumption of feeding the patient, a gastro-enterostomy, if the anastomosis be of sufficient size, may benefit permanently as well. With the closure of the jejunal fistula, the stomach is in precisely the same condition as if the operation had been restricted merely to the closure of the perforation.

Of the permanent benefits gained by adding a gastro-enterostomy to the closure of a perforation, it is stated that by preventing recurrence of ulceration it at the same time necessarily prevents a remote recurrence of the perforation. Four cases, collected from the literature, of remote perforation after simple suture of a primary perforation in which this accident might have been prevented by a simultaneous gastro-enterostomy were reported by the writer in his previous paper, and to these must be added the case reported by French,³⁵ in which the recurrence of the perforation took place four years after the primary suture, and the case reported by Mitchell,⁸² recurring at the same site some months after the original operation. That such a relapse is not impossible when a gastro-enterostomy is added to the closure of perforation, is demon-

strated by the case reported by Petréⁿ,¹⁰² in which, nine months after the suture of a perforation plus a posterior gastro-enterostomy, a perforation recurred at the site of anastomosis.

Moreover, that gastro-enterostomy will not always prevent perforation is well demonstrated by the cases of remote perforation occurring after gastro-enterostomy for simple ulcer uncomplicated by perforation. Thus the writer collected from the literature and reported in his previous paper eight perforations of this character at some point in the stomach remote from the anastomosis and three others occurring at the anastomosis. To these must be added the case reported by Petréⁿ,¹⁰² Busch,¹⁷ Morton,⁹⁰ and Moreau.⁸⁴

Probably one of the strongest pleas in favor of adding a gastro-enterostomy to the closure of a perforation is that such a measure affords permanent relief from the persistence or recurrence of ulcer symptoms. The writer has succeeded in collecting 36 cases in which the persistence of symptoms after the simple closure of a perforation demanded a gastro-enterostomy for their relief. Two others must be added to this number, observed by the writer himself. In one of these, Case III reported in the previous paper, the patient remained well for three and one-half years after the closure of the perforation. The symptoms of ulcer then recurred, and at the end of two years a gastro-enterostomy was done in a German hospital, since which time the patient has been in perfect health.

In the second case a duodenal perforation had been closed by suture and an omental flap; months afterward, the patient having been perfectly well in the interval, symptoms indicating pyloric obstruction with gastric stasis developed and were completely relieved by a posterior gastro-enterostomy.

In all of these cases a gastro-enterostomy at the time of closure of the perforation would probably have obviated a second operation, but it is quite questionable in the writer's opinion whether under these circumstances the operations for the perforation would have resulted without mortality.

As a matter of fact, an analysis of the cases requiring

secondary gastro-enterostomy shows that the interval between the primary closure of the perforation and the secondary gastro-enterostomy, even when only eight or nine days, was sufficient to permit of the patient's recovery from the effect of the primary operation as well as to allow for the subsidence of the peritonitis—facts to which could be ascribed in part at least the absence of mortality associated with the secondary gastro-enterostomy.

Two exceptions to these favorable results occur in the case reported by French,⁸⁵ in which after the plication of the peritoneum to form a channel from the abdominal wall to an inaccessible perforation near the cardia, the symptoms of the ulcer persisted and were not relieved either by separation and division of the adhesions or by a subsequent gastro-enterostomy, and in the case reported by Petré¹⁰² of suture for a perforation on the anterior wall of the stomach followed by suppuration in the abdominal wall. The gastric symptoms persisted and at the end of two years the patient consented to a posterior gastro-enterostomy, which was done without benefit.

The table of cases requiring subsequent gastro-enterostomy for the persistence of gastric symptoms might well be supplemented by another, comprising cases in which the persistence of gastric symptoms warranted a gastro-enterostomy, to which, however, the patients would not consent. Of these, 13 were collected and reported by the writer in his previous paper.³⁰

SUTURE FOLLOWED BY SECONDARY GASTRO-ENTEROSTOMY.

(10) Ten successful cases, cited in previous paper.

(11) Cuff:¹²⁵ Anterior gastro-enterostomy six weeks after suture of ulcer.

(12) Steinthal:¹⁰³ Posterior gastro-enterostomy antecolica anterior three years after original perforation.

(13) —: Posterior gastro-enterostomy eight weeks after because of recurrent symptoms.

(14) Dege:¹²⁶ Gastro-enterostomy on ninth day on account of pyloric obstruction.

(15) Mitchell:⁸² Gastro-enterostomy eight days after on account of duodenal obstruction.

(16) Schoemaker:¹⁰⁶ Gastro-enterostomy two months after perforation for belching and gastric pain.

(17) —: Four weeks after perforation; gastro-enterostomy for retention symptoms of two weeks.

(18) Moynihan:⁸⁸ Several months after perforation, gastro-enterostomy for stenosis.

(19) —: Several months after perforation, gastro-enterostomy for stenosis.

(20) —: Four years after perforation, hour-glass stomach found.

(21) Mayo:⁷⁸ Details not mentioned.

(22) Marnoch:⁷⁴ Details not mentioned.

(23) —: Details not mentioned.

(24) Carwardine:²⁰ Details not mentioned.

(25) —: Details not mentioned.

(26) Battle:⁷ Anterior gastro-enterostomy two months after perforation. Peptic ulcer 22 months.

(27) —: Anterior gastro-enterostomy 12 months after perforation.

(28) Allaben:⁴ Posterior gastro-enterostomy three weeks after perforation for stenosis. Nineteen months after, gastric carcinoma.

(29) —: Posterior gastro-enterostomy two months after perforation for stenosis.

(30) Morton:⁹⁰ Gastro-enterostomy six months after perforation. Hour-glass stomach found.

(31) Mitchell:⁹¹ Gastro-enterostomy on eighth day after perforation for gastric dilatation.

(32) —: Gastro-enterostomy 18 months after perforation on account of stenosis.

(33) Eliot: Posterior gastro-enterostomy for stenosis three and a half years after perforation, done in Germany.

(34) —: Posterior gastro-enterostomy seven months after suture of a pyloric perforation on account of pyloric stenosis.

(35) Miller:¹²⁷ Posterior gastro-enterostomy several weeks after the suture of a perforation on account of stenosis. Recovery.

(36) Jopson:⁶³ Gastro-enterostomy two years after the suture on account of the recurrence of gastric symptoms and stenosis. Recovery.

(37) Patterson:⁹⁷ No details mentioned.

(38) —: No details mentioned.

SUTURE FOLLOWED BY SECONDARY GASTRO-ENTEROSTOMY WHICH FAILED TO RELIEVE THE SYMPTOMS.

(a) French:⁸⁵ Incomplete suture of perforation near the cardia; subsequent pain not relieved by division of adhesions or a secondary gastro-enterostomy.

(b) Petré:¹⁰² Gastro-enterostomy two years after the suture of a perforation. Symptoms not relieved. Two years after gastro-enterostomy patient was still a semi-invalid.

SUTURE FOLLOWED BY PERFORATION OF COEXISTING ULCERS
WITHIN ONE MONTH.

Cited by Brunner:¹⁶ Twelve cases.

(13) Wharton:¹²² Nineteen days after closure of gastric ulcer, second perforation closed by suture of which the site is not mentioned.

(14) Ross:¹²³ One week after closure of duodenal ulcer recurrent perforation. Autopsy showed primary perforation closed. Recurrent perforation an inch or so away in duodenum. Four other ulcers on posterior wall of duodenum. Thinks a gastro-enterostomy at the time of original operation might have saved the man, whose condition was too desperate to permit of its being done.

SUTURE WITH GASTRO-ENTEROSTOMY FOLLOWED BY ULCERS
WITHIN ONE MONTH.

(a) Schoemaker:¹⁰⁵ Twelve hours after suture with gastro-enterostomy in pyloric perforation. Place at which perforation occurred had been palpated at time of primary operation and no trace of ulcer had been found. Death.

(b) Dahlgren:²⁴ Secondary perforation 12 days after first operation.

(c) —: Secondary perforation 14 days after an anterior gastro-enterostomy with entero-anastomosis, gastrostomy, and typhlostomy in site of original perforation.

SUTURE FOLLOWED BY REMOTE PERFORATION.

(a) Cited in previous paper four cases.

(b) French:²⁵ One case four years after excision and suture.

(c) Mitchell:⁸² One case recurring in same site (duodenum) eight months after suture.

(d) Andrew:² Perforation on posterior surface six months after suture of one on anterior surface of which there was no trace.

(e) Peck:⁹⁹ One year after suture duodenal ulcer.

SUTURE WITH GASTRO-ENTEROSTOMY FOLLOWED BY REMOTE
PERFORATION.

(a) Petré:¹⁰² Suture with posterior gastro-enterostomy followed two days later by entero-anastomosis on account of threatened vicious circle. Nine months later perforation at site of anastomosis. Operation. Recovery.

(b) Wharton:¹²² Suture with gastro-enterostomy by Deaver.²⁷ One year later perforation closed by Wharton. One year later a third perforation closed by Wharton.

(c) Maylard:⁸⁸ Suture and anterior gastro-enterostomy. Two perforations of peptic ulcers seven months and two years afterward.

SUTURE FOLLOWED BY HEMORRHAGE.

(a) Cited by Brunner:¹⁶ Eight cases.

(b) Cited by Eliot:⁸⁰ One case.

(c) Wallis:¹¹⁷ Hemorrhage 31 days after suture in case complicated on eleventh day with phlebitis and on seventeenth day with pneumonia. Death.

SUTURE WITH GASTRO-ENTEROSTOMY FOLLOWED BY HEMORRHAGE.

(a) Steinthal:¹⁰⁸ Seven days after suture with posterior gastro-enterostomy. Death.

(b) Mühsam:⁸³ Twentieth day after posterior gastro-enterostomy and suture. Ulcer diet. Recovery.

(c) Dahlgren:²⁴ Three weeks after suture with posterior gastro-enterostomy and entero-anastomosis. Death.

GASTRO-ENTEROSTOMY FOR ULCER FOLLOWED BY PERFORATION WITHIN ONE MONTH AFTER OPERATION.

(a) Collected in previous paper by writer, eight cases.

(b) Petré:¹⁰² Sixteen days after anterior gastro-enterostomy for ulcer. Death.

(c) Graf:²⁹ Perforation one month after gastro-enterostomy for callous ulcer of lesser curvature. Death.

(d) Rubritius:¹⁰³ Perforation two days after gastro-enterostomy for hour-glass stomach with ulcer on lesser curvature.

(e) Collinson:²³ Perforation of jejunal ulcer 13 days after gastro-enterostomy for duodenal ulcer. Death.

(f) Hamann:⁴¹ Perforation of jejunal ulcer 26 days after gastro-enterostomy. Death.

GASTRO-ENTEROSTOMY FOR ULCER FOLLOWED BY REMOTE PERFORATION.

(a) Collected by writer in previous paper, eight cases remote from site of anastomosis.

(b) Petré:¹⁰² Four months after posterior gastro-enterostomy at point remote from anastomosis. Recovery.

(c) Busch:¹¹ Seven months after posterior gastro-enterostomy for a pyloric ulcer.

(d) Three cases cited by author in previous paper occurring at anastomosis.

(e) Morton:⁹⁰ Three and a half months after gastro-enterostomy occurring at junction. Repeated three and a half months later.

(f) Moreau:⁵⁴ Perforation of ulcer at site of gastro-enterostomy done seven years before.

GASTRO-ENTEROSTOMY FOR ULCER FOLLOWED BY HEMORRHAGE.

(a) Krogus:²⁹ Six days after posterior gastro-enterostomy. Death.

(b) Three weeks after anterior gastro-enterostomy with entero-anastomosis. Death.

(c) Krogus:²⁹ One day after anterior gastro-enterostomy with entero-anastomosis. Death.

(d) Küttner:⁶⁴ Two cases, one day and three weeks after gastro-enterostomy, type not mentioned.

(e) Borszeky:¹² One case, fatal four hours after gastro-enterostomy from peptic ulcer of œsophagus.

One case, fatal 12 days after gastro-enterostomy from peptic ulcer of œsophagus.

(f) Dahlgren:²⁴ One case died eight days after gastro-enterostomy from an ulcer of the body eroding the splenic artery.

One case died four days after gastro-enterostomy from an ulcer of the body eroding an artery in the pancreas.

One case died 36 hours after gastro-enterostomy from an ulcer of the duodenum eroding the portal vein.

(g) Hofmann:⁴⁸ One case of fatal hemorrhage 29 days after gastro-enterostomy for callous gastrohepatic ulcer.

(h) Kreuzer:⁶⁸ One case of fatal hemorrhage from a pyloric ulcer two days after gastro-enterostomy.

(i) Kramer:⁶⁷ One case of fatal hemorrhage from pyloric ulcer 25 days after gastro-enterostomy.

(j) Lambotte:⁶⁸ One case of severe hemorrhage immediately after gastro-enterostomy. Recovery.

(k) Mayer:⁷⁷ One fatal case seven days after gastro-enterostomy for hour-glass stomach.

One fatal case eight days after gastro-enterostomy for pyloric obstruction (jejunal ulcer).

One fatal case 10 days after gastro-enterostomy for multiple ulcers.

(l) Rubritius:¹⁰⁸ One fatal case 10 days after gastro-enterostomy for hour-glass stomach.

One severe case immediately post-operation. Relaparotomy and ligation of bleeding vessel in gastro-enterostomy wound. Recovery.

(m) Vautrin:¹¹⁸ Two cases of bleeding duodenal ulcer died one and two days respectively after gastro-enterostomy.

(n) White:¹¹⁹ One case died shortly after gastro-enterostomy for gastric ulcer.

(o) Mayer:⁷⁷ One case of fatal hemorrhage one year after gastro-enterostomy for ulcer, site not stated.

One case of ulcer of the body died three months after gastro-enterostomy of acute inanition accompanied by vomiting of blood.

(p) Schulz:¹⁰⁶ One severe case 16 months after gastro-enterostomy for pyloric ulcer.

(q) Vautrin:¹¹⁸ One severe case 15 months after gastro-enterostomy for bleeding ulcer.

(r) Dahlgren:²⁴ One case of ulcer of the body had severe hemorrhages 10 days after gastro-enterostomy and frequently after the second year until lost sight of in the eighth year.

(s) Deaver:²⁷ One case died of inanition with blood in the stools two months after gastro-enterostomy.

(t) Hofmann:⁴⁸ One case of repeated severe hemorrhages beginning in the second year post-operation and lasting over a period of five years.

(u) Kreuzer:⁶⁸ One case of severe hemorrhage 13 months after gastro-enterostomy for florid pyloric ulcer.

(v) Kramer:⁵⁷ One case of fatal hemorrhage from an ulcer at the site of a gastro-enterostomy, occurring 14 days after a resection done because of repeated hemorrhages following the gastro-enterostomy.

GASTRO-ENTEROSTOMY FOR ULCER FOLLOWED BY CARCINOMA.

(a) Graf:⁵⁸ Four and one-half years after posterior gastro-enterostomy with button, carcinoma of the stomach with glandular metastasis.

(b) Allaben:⁵ Carcinoma 19 months after a posterior gastro-enterostomy.

(c) Bamberger:⁶ In his voluminous statistics finds carcinoma in 2 per cent. of cases developing in old ulcer after gastro-enterostomy.

GASTRO-ENTEROSTOMY AT TIME OF CLOSURE OF PERFORATION—RECOVERIES.

No. 1. Braun:¹³ Closed by omental flap. Anterior gastro-enterostomy. Well three and a half years.

Nos. 2, 3. Patterson:⁹⁷ Gastro-enterostomy. Well 24 and 15 months.

Nos. 4, 5. Moynihan:⁸³ Suture and posterior gastro-enterostomy.

No. 6. Brentano:¹⁴ Suture and anterior gastro-enterostomy and entero-anastomosis. Recurrent perforation months after. Posterior gastro-enterostomy.

No. 7. Musser and Keen:⁶⁰ Operation 6 hours after perforation. Closure; gastro-enterostomy with Murphy button. Retention of button.

No. 8. Caird:¹⁸ Female, 22. Operation 19 hours after perforation. Closure and posterior gastro-enterostomy for recurrence 13 months after primary operation.

No. 9. Caird: Male, 35. Closure and posterior gastro-enterostomy.

No. 10. Caird: Closure and posterior gastro-enterostomy on account of constriction.

No. 11. Howitt:⁴⁰ Excision, suture and anterior gastro-enterostomy, Murphy button for pyloric.

No. 12. Noetzel:⁹⁴ Male, 31. Operation 9 hours after perforation. Excision, suture and posterior gastro-enterostomy. Patient well two and a half years.

No. 13. Noetzel: Male, 33. Operation 40 hours after perforation. Excision, suture for pyloric.

No. 14. Noetzel: Male, 25. Excision, suture for pyloric. General peritonitis.

No. 15. Haim:⁴⁰ Female, 70. Operation 5 hours after perforation. Closure and posterior gastro-enterostomy for pyloric. Suture constriction.

No. 16. Körte:⁵⁴ Posterior gastro-enterostomy, dilatation of the stomach.

No. 17. Brentano:¹⁴ Posterior gastro-enterostomy, thickening of pylorus.

No. 18. *Ibid.*: Posterior gastro-enterostomy, callous edges of ulcer.

Nos. 19, 20. *Ibid.*: Posterior gastro-enterostomy, suture constriction.

No. 21. Hartwell:⁴² Closure and posterior gastro-enterostomy, Murphy button, suture constriction.

No. 22. Brewer:¹⁵ Closure and posterior gastro-enterostomy for recurrent perforation.

No. 23. Martin:⁸⁹ Closure and posterior gastro-enterostomy, Murphy button, suture constriction.

No. 24. Petré:¹⁰² Operation 6½ hours after perforation. Excision, suture, anterior gastro-enterostomy, antecolica and entero-anastomosis.

No. 25. *Ibid.*: Operation 11 hours after perforation. Excision, suture, posterior gastro-enterostomy, entero-anastomosis third day for vicious circle.

No. 26. Steinthal:¹⁰⁸ Operation 2 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus.

No. 27. *Ibid.*: Operation 4 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus.

No. 28. *Ibid.*: Operation 12 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus.

No. 29. *Ibid.*: Operation 7 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus.

No. 30. Muhsam:⁸⁶ Operation 12 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus.

No. 31. *Ibid.*: Operation 3 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus. Recovery complicated by bloody stool twentieth day.

No. 32. *Ibid.*: Operation 3 hours after perforation. Suture and posterior gastro-enterostomy for upper pyloric perforation.

No. 33. *Ibid.*: Operation 12 hours after perforation. Suture and posterior gastro-enterostomy (Murphy) for perforation duoden. pyloric.

No. 34. *Ibid.*: Operation 22 hours after perforation. Suture and anterior gastro-enterostomy, antecolica; perforation upper posterior pylorus.

No. 35. Kroiss:⁸² Operation 28 hours after perforation. Suture and posterior gastro-enterostomy, Murphy. Complication thrombosis.

No. 36. *Ibid.*: Operation 18 hours after perforation. Gastro-enterostomy, antecolica posterior, Murphy. Mesocolon contracted.

No. 37. *Ibid.*: Operation 21 hours after perforation. Posterior gastro-enterostomy, Murphy. Pylorus probably closed.

No. 38. Blake:¹¹ Operation 4 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation.

No. 39. Murphy:⁸⁷ Operation 9 hours after perforation. Suture and posterior gastro-enterostomy, suture constriction.

Nos. 40, 41, 42. Moynihan:⁸⁵ No details given.

Nos. 43, 44, 45. Mayo:⁷⁸ Suture and posterior gastro-enterostomy.

No. 46. Morton:⁹⁰ Details not given.

No. 47. McWilliams:⁷³ Operation 6 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation.

No. 48. *Ibid.*: Operation 12 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation.

No. 49. *Ibid.*: Operation 7 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation.

No. 50. Downes:²⁹ Posterior gastro-enterostomy and overlapping of the gall-bladder, pyloric.

No. 51. Harrison:⁴³ Suture and posterior gastro-enterostomy anterior wall. Empyema and fecal fistula.

No. 52. Carwardine:²⁰ No details.

No. 53. *Ibid.*: No details.

No. 54. Maylard:⁶⁸ Suture and anterior gastro-enterostomy. Seven months later perforation, peptic ulcer 1½ inches below anastomosis. Two years later perforation in efferent jejunum close to mesentery one inch below.

No. 55. Finsterer:²³ Operation 10 hours after perforation. Suture and posterior gastro-enterostomy, suture stenosis.

No. 56. Noall:⁶⁸ Operation 42 hours after perforation. Suture and posterior gastro-enterostomy for duodenal perforation.

No. 57. Woolsey:¹²³ Operation 6 hours after perforation. Suture and posterior gastro-enterostomy for perforation near pylorus.

Nos. 58, 59, 60, 61. Mitchell:²¹ All within fifth hour, posterior gastro-enterostomy. No details.

No. 62. *Ibid.*: Operation 4 hours after perforation. Anterior gastro-enterostomy (fat mesocolon) for recurrent duodenal perforation.

No. 63. Pernitza:¹⁰¹ Operation 6 hours after perforation. Suture and posterior gastro-enterostomy, suture constriction, anterior pylorus.

No. 64. Krogius:⁶⁹ Operation 3 hours after perforation. Suture and posterior gastro-enterostomy, suture constriction, anterior pylorus.

No. 65. Milko:⁶¹ Operation 3 hours after perforation. Gastro-enterostomy, marked pyloric stenosis, later entero-anastomosis, vicious circle.

No. 66. Stirling:¹¹⁰ Operation 9 hours after perforation. Suture and posterior gastro-enterostomy, pyloric stenosis.

Nos. 67, 68. Lundblad:¹²⁹ Suture and posterior gastro-enterostomy, Murphy button for pyloric perforation.

No. 69. Kronlein:⁶¹ Operation 5 hours after perforation. Suture and posterior gastro-enterostomy and entero-anastomosis for pyloric perforation.

No. 70. *Ibid.*: Operation 5 hours after perforation. Suture and posterior gastro-enterostomy and entero-anastomosis for duodenal perforation.

No. 71. Von Khautz:¹¹⁶ Operation 6 hours after perforation. Suture and posterior gastro-enterostomy for pyloric ulcer with induration.

No. 72. *Ibid.*: Operation 3 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation.

No. 73. Lecene:⁶⁶ Operation 6 to 12 hours after perforation. Suture and posterior gastro-enterostomy for perforation on lesser curvature.

No. 74. *Ibid.*: Operation 6 to 12 hours after perforation. Suture and posterior gastro-enterostomy for perforation on lesser curvature.

No. 75. *Ibid.*: Operation 6 to 12 hours after perforation. Suture and posterior gastro-enterostomy for duodenal perforation.

No. 76. Dandelski:²² Operation 4 hours after perforation. Suture and posterior gastro-enterostomy for perforation anterior pylorus.

No. 77. Sonnenburg:¹⁰⁷ Operation 30 hours after perforation. Suture and posterior gastro-enterostomy and omental flap for callous pyloric. Murphy button.

No. 78. Nordmann:⁹⁵ Operation 6 hours after perforation. Excision, suture and posterior gastro-enterostomy for perforation, induration, lesser curvature.

No. 79. *Ibid.*: Operation 2 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation complicated by pneumonia.

No. 80. Hofmeister:⁴⁷ Operation 20 hours after perforation. Suture and posterior gastro-enterostomy for perforation of duodenum.

No. 81. Monnier:⁷⁹ Operation 20 hours after perforation. See Kroiss table. Reference not found.

No. 82. Ward:¹¹⁸ Operation 6 hours after perforation. See Kroiss table. Reference not found.

No. 83. *Ibid.*: See Kroiss table. Reference not found.

No. 84. Wickerhauser:¹²⁰ Operation 4¾ hours after perforation. See Kroiss table. Reference not found.

No. 85. Falkenburg:²¹ Operation 20 hours after perforation. From Kroiss table. Reference not given.

No. 86. Körte:⁵³ Suture and posterior gastro-enterostomy, suture constriction.

No. 87. Brentano:¹⁴ Suture and posterior gastro-enterostomy, suture constriction.

No. 88. Petré:¹⁰² Operation 8 hours after perforation. Suture and gastro-enterostomy, antecolica anterior for duodenal perforation.

No. 89. Blake:²¹ Male, 31. Operation 3 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation in indurated ulcer.

GASTRO-ENTEROSTOMY AT TIME OF CLOSURE OF PERFORATION—FATALITIES.

No. 1. Moynihan:⁸⁵ Details not given.

No. 2. Caird:¹⁸ Female, 37. Operation 17 hours after perforation. Suture and posterior gastro-enterostomy for large pyloric perforation; suture constriction.

No. 3. *Ibid.*: Female, 31. Operation 10 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation; suture constriction.

No. 4. *Ibid.*: No details; posterior gastro-enterostomy necessary from suture constriction.

No. 5. *Ibid.*: No details; posterior gastro-enterostomy necessary from suture constriction.

No. 6. Miles:⁸⁰ Male, 49. Suture and posterior gastro-enterostomy for thickened pyloric perforation.

No. 7. *Ibid.*: Suture and posterior gastro-enterostomy for duodenal perforation; suture constriction.

No. 8. Noetzel:⁸⁴ Male, 23. Operation 72 hours after perforation.

Excision, suture and omental flap for pyloric perforation, posterior gastro-enterostomy.

No. 9. *Ibid.*: Male, 65. Operation 3 hours after perforation. Suture and omental flap for pyloric perforation, Murphy button, posterior gastro-enterostomy.

No. 10. Körte:⁵⁵ Operation 24 hours after perforation. Suture and posterior gastro-enterostomy, suture constriction.

No. 11. *Ibid.*: Operation 24 hours after perforation. Suture and posterior gastro-enterostomy, suture constriction.

No. 12. Petrén:¹⁰² Operation 6 hours after perforation. Suture and gastro-gastrotomy for perforation. Hour-glass stomach.

No. 13. Petrén:¹⁰² Operation 1 hour after perforation. Suture and gastro-enterostomy, antecolica anterior. Death from vicious circle.

No. 14. *Ibid.*: Operation 23 hours after perforation. Suture and gastro-enterostomy, antecolica anterior, entero-anastomosis, stenosis of pylorus.

No. 15. *Ibid.*: Operation 3 hours after perforation. Suture imperfect for perforation on posterior pylorus, posterior gastro-enterostomy.

No. 16. Jaffe:⁵² Operation 16 hours after perforation. Posterior gastro-enterostomy, suture constriction. Death the result of gastro-enterostomy.

No. 17: Steinthal:¹⁰³ Operation 6 hours after perforation. Posterior gastro-enterostomy, Murphy button. Death 7th day from hemorrhage.

No. 18. *Ibid.*: Operation 7 hours after perforation. Posterior gastro-enterostomy, Murphy button. Death 3½ months from subphrenous abscess.

Nos. 19, 20. Mayo:⁷⁸ Suture and posterior gastro-enterostomy.

No. 21. Dahlgren:²⁴ Suture and anterior gastro-enterostomy, entero-anastomosis for pyloric perforation. Death 12 days later from recurrent perforation.

No. 22. *Ibid.*: Death from gastric and intestinal hemorrhage 3 weeks after.

No. 23. *Ibid.*: No details given.

No. 24. Finsterer:²⁹ Operation 7 hours after perforation. Suture and posterior gastro-enterostomy, pyloric-duodenal perforation, pneumonia eighth day.

No. 25. Downes:²⁹ Posterior gastro-enterostomy, suture constriction. Death eighth day from pneumonia.

No. 26. Von Khautz:¹¹⁰ Operation 3 hours after perforation. Suture and posterior gastro-enterostomy for pyloric perforation.

No. 27. *Ibid.*: Operation 8 hours after perforation. Suture and posterior gastro-enterostomy for posterior pyloric. Death from peritonitis.

No. 28. Borszeky:¹² Operation 96 hours after perforation. Excision, suture and posterior gastro-enterostomy for duodenal perforation. Death 6 hours after.

No. 29. Leriche:²⁷ Operation 12 hours after perforation. Suture impossible, large callous pyloric ulcer, gastro-enterostomy with extra-peritoneal suture of pylorus.

No. 30. Nordmann:⁹⁵ Operation 24 hours after perforation. Excision of edges, suture and posterior gastro-enterostomy for anterior pyloric perforation. Death sixth week after from meningitis.

A condensed tabulation of the foregoing cases gathered from the literature and from the writer's experience gives a total of 75 cases in which a gastro-enterostomy added to the closure of a perforation might have prevented the occurrence of either some further complication or the persistence of the ulcer symptoms:

After suture only: (*a*) perforation of coexisting ulcers within one month after suture of the primary perforation, 14; (*b*) hemorrhage from coexisting ulcers, 10; (*c*) remote perforations, 8; (*d*) persistence of symptoms relieved by gastro-enterostomy, 38; (*e*) persistence of symptoms indicating gastro-enterostomy, in which the operation was refused by the patients, 19.

In contrast to this table, however, is one in which gastro-enterostomy added to the closure of the perforation failed to prevent subsequent complication.

After suture plus gastro-enterostomy: (*a*) perforation of coexisting ulcers within one month, 3; (*b*) hemorrhage from coexisting ulcers, 3; (*c*) remote perforations, 15; (*d*) persistence of symptoms not relieved by secondary gastro-enterostomy, 2.

The supposed disadvantages of adding a gastro-enterostomy to the closure of a perforation have already been enumerated. In regard to the prolongation of the operation, it may be stated that in many cases, especially shortly after perforation, the general condition of the patient is such that an added gastro-enterostomy does not materially increase the risk. In other cases in which the peritonitis is advanced or virulent, the condition of the patient renders an early termination of the operation imperative, and a gastro-enterostomy should be done only in those rare instances in which the suture of the perforation closes the lumen of the gut. There are a considerable number of border-line cases, and while the writer feels that here a gastro-enterostomy, if rapidly and skilfully

done, would scarcely increase the risk, yet it must be recognized that the operation is one of emergency and that these patients may fall to the lot of one relatively inexperienced in the technic of intestinal anastomosis. If this proves to be the case, the chances of recovery will be materially increased by the omission of the gastro-enterostomy. The argument frequently advanced that the addition of a gastro-enterostomy barely prolongs the operation for ten minutes should be modified by stating that only in the hands of the most experienced and skilled surgeons can this operation be completed in such a short time. As a matter of fact, the writer believes that even in skilled hands anastomosis by suture prolongs an operation for perforation by considerably more than ten minutes. Thus, in three cases to which the writer refers, the total duration of closure of the perforation plus gastro-enterostomy by suture required between one hour and five and one hour and fifteen minutes, whereas the average time for the closure of a perforation is, in the writer's personal experience, between 20 and 40 minutes. In other words, in operations of emergency which frequently must be done by the general surgeon rather than by the most skilled and experienced, it is unwise and even dangerous, in order to gain some slight advantage, to advocate a method of treatment which cannot generally be adopted without detriment to the patient. To be sure, if speed is essential, a gastro-enterostomy can be done with a Murphy button or other mechanical contrivance, but the opening made in this way may ultimately contract, and in that event can benefit only for as long as it remains patent. Notwithstanding the fact, however, that its benefit may not be as permanent as if a larger opening had been made by suture, its advocates assert that the opening continues patent for months if not for years, and that it not only affects favorably the immediate post-operative condition of the patient but has many of the more remote advantages of a gastro-enterostomy as well. That, however, a gastro-enterostomy added to the closure of a perforation is so markedly advantageous as its advocates maintain is not at all certain. In the preceding discussion it was shown that perforations closed without gastro-enterostomy remained as

secure as those in which this measure had been added and that, in these same cases, post-operative feeding was begun as early and as safely as in cases of gastro-enterostomy for pyloric stenosis without perforation. If, then, gastro-enterostomy added to the closure of a perforation is of no immediate benefit and the remote benefit depends upon the permanence of the patency of the opening, it follows, notwithstanding the longer time required for its performance, that a gastro-enterostomy by the suture method rather than by the button or other mechanical contrivance must be the operation of choice and that, if the patient's condition does not justify the relatively longer operation, it is wiser to limit it to the mere closure of the perforation and to postpone the gastro-enterostomy until it shall have been indicated if at all by persistent or relapsing symptoms. It is only in these rare cases in which the closure of the perforation totally occludes the lumen of the bowel and in which the general condition of the patient is such as to necessitate the shortest possible operation, that a gastro-enterostomy by the button rather than by the suture is indicated.

The second argument advanced against an added gastro-enterostomy is the possibility of its opening a direct path of infection into the lesser peritoneal cavity. This argument, based upon sound theory, has proved fallacious in actual practice. The writer has found no instance of a fatality which could be ascribed to a spread of the infectious material in this direction. In the first place, the peritoneal exudate is apt to be much less infectious below the level of the transverse colon than in the neighborhood of the perforation, while the lesser cavity proper is opened through the transverse mesocolon in its most dependent part. Furthermore, any possible spread of the infection is ordinarily prevented by carefully cleaning the site of the proposed gastro-enterostomy, while the lesser cavity itself is excluded from infection by the sutures which join the edges of the divided mesocolon to the posterior surface of the stomach.

In the next place, gastro-enterostomy for simple ulcer without perforation does not always relieve that condition even

in those cases of simple ulcer in which it seems urgently indicated.

In the following tabulation of late results, as reported by each observer, there are considered: number of cases; cured; improved; not improved; died later from gastric disease; cases coming to secondary laparotomy; cases not known; and those dying of intercurrent disease.

ULCER OF PYLORUS AND PYLORIC END OF STOMACH

Reference	Variety	No.	Cured	Improved	Not improved	Died	Relaparotomy	Not known	Intercurrent death	
Borszeky ¹²	Ulcus callosum	5	4	..	1	..	(1)	..	..
	Lesser curve	1	..	..	1	..	..	..	..
	near pylorus	12	9	..	1	..	(1)	2	..	
Clairmont ¹⁹	Stenosis	110	57	11	15	8	..	19	..	
Dahlgren ²⁴	Diagnosed	1	..	..	..	1	..	..	..	Died 1½ years of carc. vent.
	Stenosis	7	5	..	1	..	..	..	1	
	Tumor	6	5	..	..	1	..	..	..	(1) Died 1½ years of carcinoma?
	Infiltrating	7	3	3	1	..	..	..	..
Deaver ²⁷.....	.....	27	16	4	3	2	(2)	..	2	
Gaudemet ³⁶....	.....	20	2	1	1	..	..	16	..	
Gilli ³⁷	Stenosis	18	12	4	1	..	(2)	1	..	
	Ulcer	2	..	1	..	..	..	1	..	
	Tumor	3	..	1	..	1	..	1	..	
Ito and Sayesi-ma ⁵¹	Stenosis	21	11	2	1	..	..	7	..	
Kramer ⁵⁷	Ulcer stenosis	33	19	10	4	..	..	..	..
Kreuzer ⁵⁸....	.....	59	34	12	6	2	(4)	5	..	(1) Died 3½ yrs. of carcinoma?
Lambotte ⁵⁸	Stenosis	8	6	1	1	..	..	..	..
	Ulcer	25	22	..	3	..	..	..	..	One case died later of secondary carcinoma.
Lieblein ⁷⁰	Stenosis	1	1	..	..	..	..	..	..
	Callous ulcer	3	1	1	1	..	..	..	..
Mayer ⁷⁷	Stenosis	29	12	9	2	..	..	..	6	
Nyrop ⁹⁵	Stenosis	23	14	5	3	..	..	..	1	
	Tumor	7	4	2	..	1	..	..	..
Rubritius ¹⁰³ ...	Ulcer	20	9	..	3	4	..	2	2	Four died later of carcinoma.
	Stenosis	29	14	7	4	2	(4)	..	2	
Denechau ²⁸	Stenosis	42	12	22	8	..	..	..	..
	Ulcer	17	5	11	1	..	..	..	..
Graf ³⁹	Stenosis	23	8	8	6	..	..	..	1	
	Ulcer	16	8	4	4	..	(4)	..	..
Hofmann ⁴³....	.....	21	16	2	1	..	..	2	..	
Schmitt ¹⁰⁴....	.....	25	18	6	1	..	..	..	..
Schulz ¹⁰⁸....	.....	36	22	7	2	2	(1)	2	1	
Stumpf ¹¹¹....	.....	9	6	2	1	..	..	..	..
Moreau ⁸⁴.....	.....	27	11	5	10	1	..	..	..	One case carcinoma.
		693	366	141	87	25		58	16	
		74						16		
		619	507		112			74		
			81.9%		18.1%					

Percentage of good results with operative mortality considered, 76.9.

ULCERS OF LESSER CURVATURE AND OF BODY DISTANT
FROM PYLORUS

Reference	Variety	No.	Cured	Improved	Not improved	Died	Relaparotomy	Not known	Intercurrent death	
Borszeky ¹²	Bleeding	1	1	Resected specimen showed invading epithelial cells. One case died later of carcinoma.
Clairmont ¹⁹.....	.....	30	9	5	9	6	..	1	..
Dahlgren ²⁴.....	.....	7	5	1	..	..	..	..	1
Gaudemet ³⁵.....	.....	8	2	3	1	2	..	..	..
Gilli ³⁷.....	.....	8	5	3	..	..	(2)	..	..
Kreuzer ⁵³.....	.....	4	2	3	..	..	(1)	..	..
Lambotte ⁶⁸.....	.....	5	3	0	..	..	..	2	..
Lieblein ⁷⁰	Callous	4	1	1	1	1	(1)	..	..
Mayer ⁷⁷.....	.....	1	..	1	..	..	..	..	..
Nyrop ⁹⁵	Tumor	6	3	2	1	..	..	..	..
Rubritius ¹⁰³.....	.....	9	7	1	..	1	..	..	..
Denechau ²⁸.....	.....	11	2	8	1	..	..	..	..
Graf ²⁷.....	.....	14	6	..	3	2	..	3	..
Hofmann ⁴⁸.....	.....	6	3	1	1	..	..	1	..
Schmitt ¹⁰⁴.....	.....	6	2	4	..	..	..	..	..
Schulz ¹⁰⁶.....	.....	8	7	1	..	..	..	..	..
Stumpf ¹¹¹.....	.....	3	1	1	1	..	..	..	..
		131	59	34	18	12		7	1	
		8								
		123	93		30			8		
			75.5%		24.5%					

Percentage of good results with operative mortality considered, 70.9.

DUODENAL ULCER

Reference	Variety	No.	Cured	Improved	Not improved	Died	Relaparotomy	Not known	Intercurrent death	
Borszeky ¹²	1	1 (4mo.)	Carcinoma.
Clairmont ¹⁹	11	6	2	2	1	..	..	..
Dahlgren ²⁴	1	..	1	..	..	..	..	..
Deaver ²⁷	10	8	2	..	..	..	..	..
Lieblein ⁷⁰	2	1	1	..	..	..	..	..
Nyrop ⁹⁵	2	1	..	..	1	..	..	..
Schmitt ¹⁰⁴	7	3	4	..	..	..	..	..
		34	20	10	2	2				
		34	30		4					
			85%		15%					

Percentage of good results with operative mortality considered, 79.9.

POSITION NOT STATED

Reference	Variety	No.	Cured	Improved	Not improved	Died	Reoperated	Not known	Intercurrent death	
Bidwell ¹⁰.....	.....	81	46	21	14	..	(5)	..	..	Three died of carcinoma?
Busch ¹⁷.....	.....	64	56	5	..	3	..	..	..
Dahlgren ²⁴	Diagnosed Bleeding	2	1	..	1	..	..	..	..
Deaver ²⁷.....	.....	16	7	3	3	1	(1)	..	2	Five died of carcinoma.
Gilli ³⁷.....	.....	6	1	3	1	..	(1)	1	..	
Küttner ⁴¹	Ulc. callosum	12	2	1	4	5	..	..	..
Gaudemet ⁵⁶.....	.....	2	1	..	..	..	..	1	..	
Mayer ⁷⁷.....	.....	2	..	2	..	..	..	..	..
Nyrop ⁸⁶.....	.....	5	..	3	2	..	..	..	..
Denechau ²⁸.....	.....	5	..	3	2	..	..	..	..
Clairmont ¹⁸.....	.....	6	2	2	2	..	..	..	..
Mayer ⁷⁷.....	.....	2	..	2	..	..	..	..	..
Rubritius ¹⁰³.....	.....	1	..	1	..	..	..	..	..
		205	116	47	29	9		2	2	
		4								
		201	163		38			4		
			81%		19%					

Good results with operative mortality considered, 75.6 per cent.

The above tabulation of 977 cases includes only those which have been followed for many months or years and excludes those dying immediately after the operation, those passing out of view, and those dying of intercurrent disease in whom the result of the gastro-enterostomy was still uncertain.

The operative mortality after gastro-enterostomy in the hands of the average surgeon is about 6 per cent. If we include this in our computation in order to learn the late results in all cases of gastric ulcer, exclusive of perforation, operated upon by gastro-enterostomy, we find the following figures: duodenal ulcer, good results, 79.9 per cent.; pyloric ulcer, good results, 76.9 per cent.; ulcer of the body distant from pylorus, good results, 70.9 per cent.; ulcers reported with the site not given, good results, 76.1 per cent.

Fourthly, a gastro-enterostomy added to the closure of a perforation does not always prevent the persistence or the recurrence of gastric symptoms. In one of the cases reported by McWilliams,⁷⁸ examination of the patient a year after the

operation disclosed a condition of hyperacidity and the persistence of the same pain and digestive disturbances that the patient experienced prior to the perforation. In another case reported by the same observer, the patient without known cause had one attack similar to those prior to the perforation of a week's duration. In the third case, the result, at the end of a year, was excellent, and the patient could eat anything without difficulty.

In one case reported by Petréⁿ,¹⁰² an anterior gastro-enterostomy with entero-anastomosis had been added to the suture of a perforation. The patient was entirely well 16 months later. In a second case of duodenal perforation to which an anterior gastro-enterostomy had been added, the symptoms recurred within three months, and the patient had been readmitted to the medical ward of the hospital.

In the fifth place patients in whom a gastro-enterostomy is added to the closure of the perforation are quite as susceptible to the possibility of subsequent jejunal ulcer as patients operated on for pyloric stenosis without perforation. Although the writer has found no instance of this complication after gastro-enterostomy in connection with perforation, Patterson,⁹⁸ Battle⁷ and Percy¹⁰⁰ have collected some 50 cases of this complication after gastro-enterostomy for ulcer.

Before dismissing the subject of the advisability of adding a gastro-enterostomy to the closure of a perforation, it may be stated, after consultation of all accessible published autopsy records, that no fatality has been found which could in any way be ascribed to the omission of that procedure. If such instances are so rare, it would seem to indicate that a gastro-enterostomy must either be entirely omitted at the time of perforation and only done subsequently when indicated by relapsing or persisting symptoms, or, in order to diminish the number of cases in which such a secondary operation would be necessary, it must be left to the judgment of the surgeon to decide in each individual instance whether the added gastro-enterostomy shall be done or not. The writer believes that with satisfactory closure, or after excision and closure

of a perforation, a gastro-enterostomy should be omitted in all cases of perforation of the cardiac end of the stomach, and that in perforation occurring in the pyloric and duodenal zones a gastro-enterostomy should be done only in cases of early perforation when the lesion is of such a character that a gastro-enterostomy would be indicated even although no perforation existed. In other words, that a gastro-enterostomy should be done in cases in which the extent of the cicatricial deformity would probably lead to the persistence or recurrence of gastric symptoms. In all doubtful cases the writer believes that the patient should receive the benefit of the doubt, and that the gastro-enterostomy should be deferred until the effect of the closure of the perforation shall be known. Should the symptoms of ulcer persist or a subsequent recurrence of the ulcer develop, gastro-enterostomy could be done as an operation of choice rather than as one of emergency. Under such conditions its mortality is so slight as to be practically negligible.

The arguments advanced in favor of and against adding gastro-enterostomy to the closure of a perforation indicate a wide difference of opinion as to the efficacy of this measure. This difference of opinion is shared not only by surgeons in widely separated centres but also by those in the same city and even on the staff of the same hospital. Through the great consideration and kindness of a number of prominent surgeons on the continent and in England, who, in their publications, have shown special interest in this subject, as well as through the courtesy of my immediate colleagues on the staff of the Presbyterian Hospital of this city, the writer is enabled to quote directly the present opinion of these experienced men in regard to this important question.

Professor Krogius, of Helsingfors, has added gastro-enterostomy to the suture of a perforation in 14 out of 60 cases during the past ten years, with a total mortality of 50 per cent. He believes that a gastro-enterostomy should be done with a Murphy button in cases in which the pylorus is evidently greatly constricted, and when the condition of the patient will unquestionably stand the prolonged operation.

Professor von Eiselsberg, of Vienna, has not changed his views

published in 1907, at which time he considered a jejunostomy more advantageous than a gastro-enterostomy, especially in facilitating the post-operative nourishment of the patient.

Professor Brentano, of Berlin, has had 22 cases with a mortality of 45 per cent. Since 1902 he has added a posterior gastro-enterostomy to the closure of all perforations within the duodenal and pyloric zones. Of these he has had 16 cases with 11 recoveries. The necessary prolongation of the operation amounts seldom to more than 15 minutes, is comparatively harmless except in "cases in extremis," and is abundantly repaid by the improved conditions of nourishment during convalescence.

Dr. Petré, of Lund, believes in adding gastro-enterostomy to the closure of a perforation only in cases in which the patient can stand the prolonged operation. The perforation should not have existed for more than 12 to 20 hours, the general condition of the patient should be good, and the heart action but slightly disturbed. Furthermore the pylorus should either be already the site of cicatricial contraction or it should be stenosed by the suture. Under these circumstances gastro-enterostomy probably increases the chances of recovery. Only a minority of those in whom the perforation has been closed without gastro-enterostomy require that operation subsequently.

Professor Noetzel, of Saarbrücken, since the publication of his paper in 1906, has had six additional cases which demonstrated the value of adding gastro-enterostomy to the closure of a perforation in every case, irrespective of its location, and even when the closure of the perforation has not resulted in the constriction of the pylorus, for the reason that: (1) it corrects hyperacidity; (2) it makes recurrence less likely, and although it does not always succeed in preventing a fresh outbreak of the disease, it is the only measure which can be utilized for that purpose with any hope of success. He refers to one of his unpublished cases in which, two years after the excision and suture of a perforating ulcer on the anterior wall of the stomach, the symptoms recurred and on operation by Rehn a large ulcer was found on the posterior wall. Possibly in this case had a gastro-enterostomy been done at the time of the closure of the perforation, recurrence would not have taken place. He also refers to a second unpublished case in which a condition of general peritonitis in the case of a perforation of 72 hours' standing made a speedy termination of the operation and the omission of a gastro-enterostomy imperative. Even the extensively indurated character of the ulcer, covered with fibrinous exudate, rendered an excision in healthy tissue or excision of even the edges of the ulcer impossible. The patient recovered after a suture of the perforation but repeated examinations showed a persistent hyperacidity.

Professor Noetzel also added the notes of a most interesting case in which a perforation had developed in a large ulcer on the lesser curvature, which could be treated only by a circular resection of the middle segment of the stomach according to the method of Riedel and Payr. This was carried out accordingly, the sutures, as Payr has emphasized, being inserted without difficulty. In such a case gastro-enterostomy would not be done. The patient made an excellent recovery.

Résumé: Professor Noetzel believes in adding gastro-enterostomy to the excision and closure of all cases of perforation, except where speed is essential and where the lesion is such as to demand a circular resection.

Professor Schoemaker, of The Hague, advocates gastro-enterostomy even in cases where the pylorus is stenosed only where the condition of the patient will stand the longer operation. In cases of advanced peritonitis, speed is essential and gastro-enterostomy can be added subsequently if needed. Professor Schoemaker has had four successful cases of this character. In perforations remote from the duodenal and pyloric zones, he believes that gastro-enterostomy is useless. In severe cases the perforation is closed as quickly as possible. In other cases the ulcer is first resected.

Professor Martens, of Berlin, advocates gastro-enterostomy only when the pylorus is already the site of constriction or where this results from the closure of the perforation. In other cases he believes a speedy termination of the operation of greater value than an added gastro-enterostomy.

Dr. Kroiss states that both from his former experience in the Innsbruck clinic as well as from his later experience, he is a firm believer in the advantages gained by adding a gastro-enterostomy to the closure of a perforation. He grants, however, the possibility of obtaining satisfactory results after simple suture. He refers to one recent case operated on more than 24 hours after perforation by a colleague, in which all the advantages of the added gastro-enterostomy were clearly demonstrated.

Professor Körte, of Berlin, says that the opinion which he expressed in a paper published on this subject in Langenbeck's Archives (vol. lxxxiii) has been substantiated by further experience, and that he consequently regards a gastro-enterostomy advisable: (a) when the perforation is located at the pylorus or its immediate vicinity in such a way that its suture or subsequent cicatricial contraction may lead to pyloric stenosis; (b) he also considers that it is indicated in callous perforating ulcer of the lesser curvature which threatens to result in hour-glass stomach; (c) it should be done, however, only in patients whose general condition is sufficiently strong to permit of prolonging the operation for 15 minutes; (d) after the perforation has existed for 12-16 hours, the patient's general condition is such that a gastro-enterostomy had best not be done.

Mr. Moynihan, of Leeds, writes as follows: "With regard to the performance of gastro-enterostomy in cases of acute perforating ulcer, I reserve this operation for the cases in which the closure of the ulcer causes immediate and considerable obstruction, and those in which it seems likely that, as a final result of the ulceration and of the suture, some degree of obstruction is likely to result. If the ulcer is not causing obstruction, that is, if it is on the lesser curvature or anterior wall toward the cardiac end of the stomach, I do not perform gastro-enterostomy. I have no belief whatever in the so-called 'physiological action' of gastro-

enterostomy. This of course implies that the short-circuiting of an ulcer is called for in all cases of duodenal perforation, and in all cases in which the ulcer which has given way lies within an inch or two of the pylorus on the gastric side.

"The first case in which I performed gastro-enterostomy for a perforating ulcer was that recorded in the *Lancet*, Dec. 14, 1901—see especially page 1662, column 1. I believe it was in that paper that I was the first to advocate this operation."

Dr. W. J. Mayo, of Rochester, writes as follows: "In cases of acute perforation where the patient is in poor condition and there is a spreading peritonitis, we have closed the perforation, establishing pelvic drainage, and set the patient up in bed as a rule without irrigating the abdomen. If the patient is in fair condition, we close the ulcer by sutures and an omental graft and do a gastro-enterostomy. At one time I felt that it was better to do a gastro-enterostomy on every case of this sort, but I am convinced that I lost one case by adding the gastro-enterostomy to closure of the opening on a patient who was in poor condition."

Dr. Peck, of New York, writes as follows: "My feeling at present in regard to gastro-enterostomy at the time of closure of perforation is, that in duodenal ulcers or gastric ulcers near the pylorus where infolding by suture means probable narrowing of the pylorus, it should be done at once if the patient's condition will permit.

"In perforation of the anterior wall at a distance from the pylorus, I believe that it should not be done as a routine procedure, as in many cases it will not be needed. I have had no experience with posterior wall perforations."

The difference of opinion held by my colleagues on the staff of the Presbyterian Hospital are obvious in the following statements:

Dr. Blake believes that a gastro-enterostomy should be done when the closure of a perforation produces appreciable narrowing of the pyloric-duodenal lumen. This stenosis he is rather inclined to accentuate in the closing of the perforation.

Dr. Woolsey is inclined to do a gastro-enterostomy in duodenal perforations and in those near enough the pylorus to produce more or less stenosis.

Dr. Hawkes believes that a gastro-enterostomy is unnecessary in closure of perforations either with or without excision, unless the measure adopted causes undue constriction.

Dr. McWilliams believes that a gastro-enterostomy should be done in the cases which would stand the operation (those operated on within a few hours of the perforation). In these cases the perforation should be closed by suture which would infold the ulcerated area to the extent of practically closing its lumen. A gastro-enterostomy by suture should be done with a large stoma, at least two inches. This gives the best guarantee against the recurrence of the perforation as well as a prevention of subsequent gastric symptoms from contraction of the ulcer. This will cause very little increase in the mortality. Those perforations with marked peritonitis should not be subjected to the added strain of a gastro-enterostomy.

Dr. Hartwell believes that gastro-enterostomy is necessary if the pylorus shows a palpable narrowing with dilatation of the stomach. If the stomach is not dilated and the pylorus is not constricted, gastro-enterostomy might be omitted, but these cases are few.

The statement should be added that the members of the hospital staff were unanimous in advising a gastro-enterostomy where the suture of the perforation resulted in extensive contraction of the pylorus or duodenum, and also that a gastro-enterostomy should be omitted in all patients in whom peritonitis was advanced.

That such widely different opinions should be expressed by men of equal skill is accounted for in part, at least, by the fact that it is impossible to estimate the comparative mortality in cases treated by suture only and in those in which a gastro-enterostomy is added to the closure of the perforation. It is self-evident, if one considers the marked differences in the patients' ages, in their general condition, especially in the condition of the circulatory apparatus and the kidneys, in the virulence of the infection, in the rapidity with which the gastro-duodenal contents escape into the general peritoneal cavity, and in the duration of the perforation, that all comparison is futile. The only other sound basis of comparison, that based upon the character of the final result, is of greater although still of uncertain value. Of the final result in cases treated by suture with gastro-enterostomy, the evidence is meagre, probably owing to the fact that this method of treatment has been in general use only during the past few years.

The following cases showing final results after this procedure have been reported in the literature:

CASE 1.—MUSSEY and KEEN:⁶⁰ At the time of publication, about one and a half years after the suture of a pyloric perforation with gastro-enterostomy with Murphy button, patient still suffered from the effects of the retention of the button in the stomach.

CASE 2.—BRAUN:¹² Patient completely well three and one-half years after the closure of a perforation in the anterior wall of the stomach by an omental flap only. Owing to the friability of the stomach wall an anterior gastro-enterostomy was done.

CASE 3.—BLAKE:¹¹ Patient completely well two years after the closure of an indurated pyloric ulcer by suture plus posterior gastro-enterostomy. The patient had previously had "stomach trouble" of moderate severity extending over a considerable number of years.

CASES 4, 5, and 6.—STEINTHAL:¹⁰³ In these cases, the fact is mentioned that the ultimate result was excellent without further detail.

CASES 7 and 8.—PATTERSON:⁹⁸ Patients well 15 and 24 months, respectively, after the closure of a perforation with gastro-enterostomy. No further detail given.

CASE 9.—NOETZEL:⁹⁴ Two and one-half years after excision, suture, superposition of an omental flap, and a posterior gastro-enterostomy, patient's general health was excellent.

For the post-operative histories of the three following cases, I am greatly indebted to Dr. McWilliams. The cases were reported in the *ANNALS OF SURGERY*, vol. liii, p. 144, and the following is a report of their condition one year later:

CASE 10.—Perforation near lesser curvature and pylorus with induration. Closed by Lembert and two tiers of sutures. This patient remained well until the past week (20 months after the operation). During the past week he has suffered from constipation and three or four attacks of vomiting several hours after eating. The stomach has been sour and the tongue slightly coated. The symptoms may be due to a hernia in the scar.

CASE 11.—Twenty months ago patient J. S. was operated on by suture and posterior gastro-enterostomy for a pyloric perforation. One year after operation patient had an empyema of unknown cause. Two weeks ago patient had an attack of epigastric pain similar to that which the operation had relieved. At present he is completely well.

CASE 12.—H., 28. Patient had had from childhood almost continuous knife-like pain with vomiting, most marked at night and on lying down. Three years before the operation for the perforation the appendix was removed in another hospital without relieving the symptoms. The diagnosis of gall-stones was then made. The attack of the perforation resembled other previous attacks that had been diagnosed as gall-stone colic. At this time operation (McWilliams) disclosed a perforation in the centre of an indurated ulcer the size of an egg just to the cardiac side of the pylorus. It was closed by Lembert sutures in tiers together with a posterior gastro-enterostomy by suture.

Post-operative: For six months after the operation patient was relieved but not cured, the pain and vomiting continuing although with diminished severity. About six months after the closure of the perforation, the patient was operated on for epigastric hernia. Inspection of the stomach showed no sign of the old ulcer and a patent pylorus. Since this operation for hernia the pain has been worse than prior to the operation for perforation, and the vomiting has been just as frequent and persistent. Although patient vomits once or twice daily three or four hours after eating, there has been no loss of weight. Tongue slightly coated but clear at the tip. Occasional sour taste in the mouth. Stomach analyses by Dr. H. S. Carter show at present a marked hyperacidity.

Through the courtesy of my colleague, Dr. Blake, the history of the following case is added:

CASE 13.—J. S., male, 31. Admitted to the Presbyterian Hospital December, 1909. Patient has complained of moderate stomach trouble for years. This has consisted chiefly of epigastric pain, occurring several hours after eating and relieved by the further taking of food.

The present attack of severe epigastric pain is of three hours' duration. Immediate operation. After examination of the appendix through an intermuscular incision, the pylorus was exposed and a perforation in the centre of an indurated pyloric ulcer was found. This was closed by Lembert suture and a posterior gastro-enterostomy was added. The abdomen was closed without drainage. There was no vomiting nor indigestion during convalescence.

It is now two years since the operation, and the patient has had no stomach trouble of any kind whatever.

Of the character of the end results after suture only, the evidence is of greater value in that not only are the cases more numerous but the period of observation has extended over a longer time. An analysis of these cases appears to show that in a very considerable proportion the patient is either much improved or permanently cured. The writer, in his previous paper,³⁰ reported 53 instances collected from the literature and from his own experience, in which for periods of from one to six years the patients had been completely free from all gastric symptoms, and to this number should now be added a summary of the end results reported by Dahlgren,²⁴ Morton,⁹⁰ and Petré,¹⁰² and others.

DAHLGREN²⁴ reports well 7 years after the operation, 2 cases; 5 years after, 1 case; 4 years after, 1 case; 2 years after, 3 cases; 3 months after, 1 case; 2 cases, in which symptoms persist.

MORTON⁹⁰ reports well 3 years after the operation, 3 cases; 2 years after, 2 cases; 1 year after, 1 case; 1 case, in which symptoms persist.

PETRÉ¹⁰² reports well 6 years after the operation, 1 case; 5 years after, 2 cases; 4 years after, 1 case; 3 years after, 2 cases; 2 years after and 1 year after, of each 3 cases; less than a year, 2 cases. Of 28 cases, 15 were without symptoms; 8 had slight or occasional symptoms, and 5 had severe symptoms. This author calls attention to the fact that cases in which the perforation has occurred without warning are more likely to be permanently relieved than those in whom there has been a persistent gastric history for some years. It is also worthy of mention that, in his experience, perforations of ulcers at or near the lesser

curvature are more likely to be followed by persistent symptoms than those at or near the pylorus.

JOPSON⁵³ reports one patient who, three years after the closure of a perforation by suture, was perfectly well with the exception of occasional attacks of fermentation.

HESSERT¹²¹ reports a patient well 18 months after the simple closure of a perforation.

MCWILLIAMS⁷⁸ reports a patient well four and one-half years after the simple suture of a perforation. Two years after the operation he had one attack of indigestion.

Through the kindness of Dr. Peck, his valuable end results in cases previously reported by him and cited by the writer in his former paper⁹⁰ are herewith appended:

CASE 1 (25 in former paper).—Not traced further.

CASE 2 (26 in former paper).—Well four years after operation. Then lost sight of.

CASE 3 (27 in former paper).—Well four years after operation.

CASE 5 (28 in former paper).—Patient has occasional gastric distress after indulgence in alcohol. Otherwise well four years after operation.

CASE 7 (29 in former paper).—Patient had an ulcer in the middle of the anterior wall. Occasional pain and indigestion persisted. In January, 1911, four years after the closure of the perforation, Dr. Peck exposed the stomach which had become an hour-glass one, and relieved the patient by doing a gastro-enterostomy. The patient has been perfectly well since.

CASE 8.—In 1907 suture of duodenal perforation. One year later a second perforation occurred at the same point. This was also sutured. Fourteen days later a gastro-enterostomy was done for symptoms of pyloric stenosis. Death occurred several days later, and an autopsy showed a beginning carcinoma in the old duodenal ulcer.

A résumé of the final results operated on by the writer follows:

CASE I (reported in previous paper).—Perforation on the anterior wall of the stomach midway between the cardia and pylorus. Suture only. Patient well at the end of four years when she passed out of view.

CASE II (reported in previous paper).—Pyloric ulcer closed by suture. Patient completely well eight years after operation.

CASE III (reported in previous paper. See also secondary gastro-enterostomy after primary suture of perforation).—Patient well for three and one-half years after operation for perforation on anterior surface of first part of duodenum. Then symptoms of ulcer recurred, and two years later gastro-enteros-

tomy was done in Germany. Patient has been completely well since this last operation.

CASE IV (reported in previous paper).—Perforation on anterior wall of first part of duodenum. Patient entirely well for two and one-half years, when ulcer symptoms recurred, and he suffered from two attacks of pain. Efforts to trace him latterly have failed.

CASE V (reported in previous paper).—Perforation on the anterior wall of the stomach two inches from the pylorus near the lesser curvature. Suture. This patient made an excellent recovery but was soon lost sight of.

CASE VI (reported in previous paper).—Perforation at junction of pylorus and duodenum closed by suture. Recovery. Patient cannot be traced.

CASE VII (reported in previous paper).—Perforation on the anterior surface of the first part of the duodenum closed by suture. Patient completely well five years after the operation.

CASE VIII (reported in previous paper).—Perforation on the anterior surface of the first part of the duodenum closed by suture. Patient had advanced atheroma at the time of operation, and one year after died from intercurrent disease.

CASE IX (reported in previous paper).—Perforation on the anterior wall of the second part of the duodenum closed by suture four days after the onset. Patient died four days after the operation.

CASE X (not previously reported).—Male, aged fifty-two. Admitted to the Presbyterian Hospital, January 26, 1910.

Patient has always been well. There was a history of the excessive use of tobacco and the moderate use of alcohol. On January 16, there was epigastric discomfort especially on the right side, which soon became associated with eating but did not interfere with the patient's work (laborer). The pain was localized, of knife-like character. It lasted for about 20 to 30 minutes after eating, and was bad enough to make the patient diminish the amount of food he ate. Early on the morning of admission, as patient was leaving work (night laborer), the pain became very severe. He walked with difficulty to the trolley, and on reaching home he walked up several flights of stairs. The pain was so severe that he was brought to the hospital in an ambulance.

Physical Examination.—The tongue was markedly coated. There had been neither nausea nor vomiting at any time since

the onset. The epigastric region was retracted, and the entire abdomen moved very slightly with respiration. There was general board-like rigidity, most marked in the upper right quadrant. The upper segment of the right costal arch was also rigid, and pressure on this point as well as in the epigastric region to the right of the median line was painful. There was dulness in the right flank as far forward as the edge of the rectus muscle. The pulse was only 48 and strong. There was no rise of temperature, and respiration was only slightly quickened. There was a general leucocytosis of 13,000 and a polymorphonuclear count of 93 per cent. Three days later these had diminished to 5000 and 60 per cent. respectively.

Immediate operation eight hours after the perforation. Under gas and ether anaesthesia, the abdomen was opened through an upper right pararectal incision. A small amount of gas escaped, and a considerable yellow exudate which filled the right loin and the right lumbar gutter as far as the appendix. It did not extend into the pelvis. After removal of the exudate, examination showed an induration in the end of the first part of the duodenum, anterior surface, with a small punched-out hole in its centre. This was closed with a purse-string suture reinforced by two Lembert sutures, and after irrigation of the right lumbar gutter and the corresponding subphrenic space, into which a cigarette drain was introduced, the abdominal incision was closed in the usual way.

The recovery was without incident. At no time was the pulse over 80. Cultures taken from the exudate near the perforation showed no growth.

Present Condition.—Two years after the operation, the patient is free from all gastric symptoms.

CASE XI (not previously reported).—Male, S. J., aged thirty. Admitted to the Presbyterian Hospital June 20, 1910.

There was a history of the excessive use of tobacco, coffee, and tea. Moderate use of beer. No previous gastric history. On afternoon of admission, while working, patient was seized with a violent pain in the right hypogastrium. Patient vomited once after a glass of brandy taken in order to relieve the pain. Brought to the hospital in the ambulance.

Physical Examination.—The respiratory movement of the abdominal wall was restricted. There was general rigidity, especially in the right upper quadrant. The rigidity was least marked

in the flanks. There was bilateral costal resistance, especially in the upper right segment. The left side of the abdomen was tympanitic. The right side on auscultatory percussion showed an area of dulness extending from the margin of the rectus into the loin. The tympany in the right flank was higher pitched than on the left side. There was marked tenderness on pressure opposite the navel.

Chloroform followed by ether, four hours after the perforation. Right upper pararectal incision. There was free yellow fluid without gas in the right upper quadrant, not sufficiently abundant to have extended down the right lumbar gutter or into the pelvis, but limited to that part of the peritoneal cavity above the level of the transverse colon. There was a perforation the size of a buckshot in the upper anterior portion of the first part of the duodenum without discoverable induration. This was closed with a purse-string suture reinforced by two Lemberts, and the abdomen closed after local irrigation of the upper right portion of the peritoneal cavity. A small cigarette drain was introduced into the right subphrenic space and the abdomen closed in the usual manner.

The patient made an excellent recovery but could not be traced three months after leaving the hospital.

CASE XII (not previously reported).—Male, aged forty-four. Admitted to the Presbyterian Hospital March, 1911.

There was a history of the moderate use of alcohol and tobacco. For the past year patient has been subject to mild attacks of pain occurring from two to four hours after eating, which were relieved by further eating and by bending forward. One year ago during an attack of one week's duration there were several attacks of vomiting. During the entire year, however, he has complained of indigestion with vague sensations of pain and oppression in the epigastrium, sometimes radiating to both shoulder-blades. He has also suffered from gaseous eructations and occasionally vomited a greenish fluid.

On the day prior to his admission he had a sudden attack of pain, severe and colicky, in the epigastric region; this radiated to the left and was persistent. There was no history of vomiting. The bowels had not moved for 48 hours and two enemas had been given without result. Upon admission the abdomen was found moderately distended; it was very rigid, especially in the right upper quadrant, with generalized tenderness and tympany except

in the right flank, where dulness as far forward as the edge of the rectus was elicited. A rectal examination was negative, revealing no tenderness. The patient's temperature was 99.5° ; pulse, 116; respirations, 24. A blood count showed 7000 white blood-cells with 87 per cent. polymorphonuclears. The urine contained a heavy trace of albumin and casts. The patient was seen in consultation by Dr. Harold of Macon, Ga., who made the correct diagnosis.

Operation 36 hours after perforation. Under ether anaesthesia, the abdomen was opened through a right upper pararectal incision. This incision was subsequently enlarged by a transverse incision extending from its upper part toward the median line. There was an immediate gush of a large quantity of turbid, dark-colored fluid, containing gastric and duodenal contents, which completely filled both subdiaphragmatic spaces as well as the space between the left lobe of the liver and the anterior abdominal wall. The right lower half of the abdomen and the pelvis were also filled with fluid of the same character. The fluid was thicker, more grumous, and more offensive about the pyloroduodenal junction than at more distant points. A perforation in an indurated ulcer of the size of a 25-cent piece was found in the anterior upper wall of the duodenum just beyond the pylorus. It was closed by a purse-string suture reinforced by two Lembert sutures. The peritoneal cavity was cleansed by general irrigation, and cigarette drains were introduced into either subdiaphragmatic space above and through a counteropening above the symphysis into the pelvis below. The abdominal incision was then rapidly closed in the usual manner.

Post-operative.—The patient made an excellent recovery from the anaesthetic. On the day after the operation his pulse was less than 100 and there was no nausea or vomiting. Fluids by mouth were given from the fifteenth hour. For a week the drainage was satisfactory. The discharge from the suprapubic opening was serous, and after the drain was removed on the fifth day the sinus rapidly closed. The discharge from the upper opening was offensive and purulent, and some of the sutures giving way the wound healed slowly by granulation. At the end of ten days the temperature chart and blood counts indicated pus retention, and as the patient's condition did not warrant posterior drainage through the pleura, the device of attaching siphon drainage to a catheter introduced into either subdiaphragmatic space was adopted with

excellent results. The sinuses ultimately closed, the one between the left lobe of the liver and the anterior abdominal wall, which was the least deep, was the last to heal. Three months after the closure of the perforation a stomach analysis showed no hyperacidity. Nine months after the operation a second gastric analysis showed a moderate hyperacidity. In all other respects, however, the patient is perfectly well.

CASE XIII (not previously reported).—Female, aged twenty. Referred to me by Dr. H. R. Charlton of Bronxville, to whom I am greatly indebted for the subsequent post-operative history.

For the past two years she had been treated by various medical men for an "acid stomach," receiving a large amount of alkalis for its relief. Eighteen months ago pain was added to her difficulties, especially severe after taking food. There was no vomiting and only slight constipation. One month before operation patient developed tenderness in the epigastric region, which increased to such an extent that the pressure of the clothing could be tolerated for short periods only. Shortly after consulting Dr. Charlton for the first time, patient took a half ounce of castor-oil and five hours later while sewing she had a sudden severe knife-like pain in the epigastrium with a feeling of faintness and vomiting. On examination there was restricted abdominal respiration, general rigidity most marked above the level of the navel and slightly to the right of the median line, moderate tenderness, no temperature; and a pulse of 100.

Operation at the Lawrence Hospital in Bronxville 18 hours after perforation. The rigidity being most intense just prior to the operation over the region of the appendix, an intermuscular incision was first made and the appendix was inspected. On opening the abdomen there escaped the characteristic fluid as frequently seen in connection with pyloric perforations, which abundantly filled the entire pelvis and the right lumbar gutter. The pylorus was then exposed by the usual upper right pararectal incision, and a perforation the size of a millet-seed found close to the junction on its anterior surface. This was rapidly closed with a purse-string suture, strengthened with two Lemberts, and the right subphrenic space and pelvis carefully cleansed by saline irrigation. The abdomen was then closed, cigarette drains being first introduced into the right subphrenic space and pelvis through the intermuscular incision.

The patient recovered well from the anæsthetic and for the

first week did very well. There was practically no vomiting, and the patient took her nourishment without difficulty. After that time patient developed a left pleurisy with effusion, a patch of pulmonary gangrene, a left-sided pelvic abscess, and multiple abscesses in the subcutaneous tissue. These different post-operative complications were all successfully weathered, however, and now, six months after the operation, Dr. Charlton tells me that the patient is eating well and gaining weight rapidly, and is able to attend to the customary household duties.

CASE XIV.—G. R., admitted to the Presbyterian Hospital March, 1910.

Three years ago patient had dull epigastric pain which was cured by lavage. In March and May, 1909, patient had similar attacks, which were relieved in the same way. In August patient was operated on at the New York Hospital for acute perforation of the pyloric-duodenal junction by Dr. Bolton. The perforation was closed by a purse-string suture reinforced by Lemberts and the superposition of an omental flap. The patient remained entirely well until two weeks ago (seven months after the operation), when the gastric symptoms recurred and vomiting, which was persistent, developed.

On physical examination the greater curvature of the stomach reached to the umbilicus and test-meals showed both gastric stasis and a lack of digestion. Further analysis showed a total acidity of 0.3 per cent., with hydrochloric acid 0.27 per cent., and no lactic acid.

Chloroform. The abdomen was opened through a median incision above the navel. The stomach was moderately enlarged. To the vicinity of the pylorus the omentum was attached, and had formed dense adhesions which were not disturbed. Through these adhesions the first part of the duodenum felt as if considerably thickened with cicatricial tissue. A typical posterior gastro-enterostomy was done, which completely relieved the patient. Twenty months after the operation the patient had had no relapse.

In conclusion, the writer wishes to emphasize the importance of publishing complete reports of both the primary and final results of all cases of perforation, irrespective of the form of treatment. It is only by a study of such frank and accurate records that the real value of the different methods of treatment of this very important lesion can be determined.

The writer also takes this opportunity to thank most sincerely Professors Körte, Krogus, Noetzel, Brentano, von Eiselsberg, Schoemaker, Martens, and Drs. Petré and Kross, together with Mr. Moynihan of Leeds, and Drs. Mayo, Peck, and McWilliams, for their kind and valuable assistance in the preparation of this paper.

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INTESTINAL OBSTRUCTION DUE TO GALL-STONES.*

WITH REPORT OF THREE SUCCESSFUL CASES.

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THE chief purpose of this communication is to present for record three successful gall-stone ileus cases that have come under my personal observation. In all three cases the condition was serious, as the obstruction had existed until they were in a most perilous and hazardous way, and nothing but the timely aid of surgery would have been of avail. There is such an abundance of literature on this subject that, at first sight, it might seem to be a somewhat common ailment. Such, however, is not the case, as numerous statistics show. It is reported (Edward¹) that up to 1910 there had been but 250 recorded cases. Bradbury² states that from 1893 to 1896, in the Rochester Royal Infirmary, there occurred but one case of this kind from a list of 50,000 patients treated. The rarity of this interesting complication of the surgery of the biliary tract, together with the unique and complex findings in my last case, have been the chief incentive that has induced me to present these cases.

CASE I.—*Gall-stone ileus, complete; operation, October 12, 1906. Recovery.*

Mrs. T. W., married, aged fifty-nine. I was called by Dr. W. W. Cissel to see this patient who was ill with an acute abdominal malady, the diagnosis of which was uncertain. The patient was a stout woman with a large abdomen; her symptoms were more or less continuous pain, constant vomiting which had recently become stercoraceous, associated with inability to have

* Read before the Southern Surgical and Gynecological Association, Dec. 13, 1911.

the bowels moved. Previous history obtained was that she had had numerous bilious attacks, which had occurred during the last twenty years. Of late these attacks had been fewer in number and less severe in character. Present illness began September 30, with acute abdominal pain and vomiting. The vomiting continued until October 3, when there was a slight let-up, but she was still nauseated and could take no nourishment. She was up and about, although complaining. On October 7 she had another attack, vomiting ugly green material, and she went to bed. The vomiting persisted more or less continuously from this time. This and the inability to have the bowels moved were the chief symptoms. The vomiting finally took on a stercoraceous character, and abdominal soreness and pain increased. There had been a slight rise in temperature, but this had subsided when I saw her. I could make out no definite evidence of appendicitis; there was some muscle stiffening; no evidence of visible intestinal coils; no definite localized mass; some slight tenderness over the gall-bladder, but nothing to make one think of cholecystitis. She was much flushed in the face; pulse was not rapid but weak; and she showed evidence of marked general weakness, due to lack of nourishment, which she had been unable to take practically since September 30. No definite diagnosis could be made other than possible intestinal obstruction from some cause, the symptoms of intestinal obstruction being present, namely, persistent colicky pain, persistent vomiting, and coprostasis. I am free to confess that gall-stone ileus did not enter my mind, as I had never seen a case. The chief point was that she needed immediate help, and this was given by laparotomy.

Operation.—The abdomen was opened through a right rectus incision above the umbilicus, the incision placed here because I thought that the trouble could probably be located in the upper or middle abdomen. When the peritoneum was opened, a lot of fluid, slightly tinged with blood, came out. The small intestines were deeply congested and ballooned, so that it was evident she had an obstruction from some cause. A hand was placed in the region of the gall-bladder, but nothing could be made out there, and the appendix was normal. Passing the hand over toward the mid-line, a mass was felt in the small intestine, which at first conveyed the impression of being a carcinoma of the small intestine. Pulling it into the wound, I found it was an ob-

structed small intestine, the point of obstruction being about five feet from the ileocæcal valve. The loops of small intestine proximal to the blocking were enormously distended, and the loops distal to this point were markedly collapsed and tape-like. It was seen that the obstruction was due to a foreign body, which was tightly impacted in the lumen of the intestine, completely obstructing it. It was so hard and rigid that no impression could be made upon it; I tried several times to force it from its lodgement, but the blunt end of the stone was forward, and it had some rough spicules, as will be seen from the specimen. My idea was to push it into the large intestine, but this was impossible. After the bowel was tucked off with gauze, a longitudinal incision was made and the stone delivered. Although there was deep congestion of the upper bowel proximal to the obstruction, at the point of impaction the bowel wall was in a recoverable condition. The proximal loop was not emptied, but the current was arrested by gauze being tied around the loop until the stone was removed. The opening was then closed by a continuous Connell suture, with Lembert sutures over it, and there was no diminution of the lumen at this point. Following the closure, the fecal current was then allowed to pass on, and it was seen to go from the ballooned to the collapsed portion, showing that the obstruction was entirely removed. A protective drain was put down to the point of incision in the bowel, and the abdomen closed around it. This was done for fear there would be leakage, and also because there was much peritoneal fluid present.

The patient was considerably shocked, due to her exhausted condition, and normal salt solution was given her. She reacted well and made an uninterrupted recovery. The vomiting ceased immediately after the obstruction had been removed. A recent report from her doctor states that she is enjoying excellent health, and has had no further gall-stone or obstructive symptoms.

I am unable to say, in this case, where the portal of entry from the gall-bladder to the intestine was, but from the size of the stone I should judge it to be through a gall-bladder-duodenal fistula.

CASE II.—*Gall-stone ileus, complete; operation, December 11, 1909. Recovery.*

Mrs. B., aged sixty-two; referred to me by Dr. H. M. Slade.

She was a stout woman with a very large abdomen. Past history: Apart from vague symptoms referable to the upper abdomen, there were no definite symptoms pointing to gall-bladder disease. Present illness: She came under my care December 9, with a history of having had definite symptoms of intestinal obstruction for ten days or two weeks, the symptoms abating only to recur. The vomiting, pain, and inability to have the bowels moved would subside and then come on again. The family were very loathe to have anything done, and postponed any operative procedure as only a *dernier resort*. When examined by me the cardinal symptoms of obstruction were noted, namely, pain and vomiting, tympany, and arrest of bowel contents. Abdominal palpation revealed nothing specific. There was no definite point of tenderness, and no marked stiffening of the belly wall. A diagnosis of obstruction without giving the cause was made, and I operated December 11.

Ether was given; a low right rectus incision made. Distended, congested small intestines bulged out into the wound, and a lot of dark, turbulent, slightly bloody fluid came out of the peritoneal cavity. A search through the abdomen was made for the point of obstruction, and as the hand passed down into the abdomen, a hard mass was felt in the small intestine—so hard and rigidly held in the bowel wall that I at first thought of an annular carcinoma of the bowel. When the loop of intestine was gotten up, it was seen to be due to a foreign body, tightly impacted, and completely blocking the lumen of the bowel. The point of blockage was in the lower ileum, about six or eight inches from the ileocaecal valve. It was impossible to budge the stone from its position, and pushing it on was out of the question. The bowel was well packed off, and a linear incision, just opposite the mesenteric border, was made and the stone removed. There was some escape of bowel contents, and soiling of the peritoneum in consequence, and there was considerable dark bloody fluid in the pelvis, so it was decided to put in drainage. Two cigarette rubber tissue drains were inserted, and the wound closed around them. The patient was placed in Fowler's position, and normal salt solution given. Vomiting ceased, the pain abated, and she made an uninterrupted recovery.

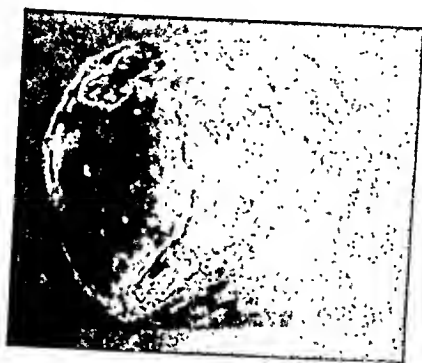
CASE III.—*Gall-stone ileus (strangulation) associated with an ulcerating process which produced an anastomosis between the*

FIG. 1.



Gall-stone causing intestinal obstruction (Case I).
Operation, Oct. 12, 1906. Recovery.

FIG. 2.



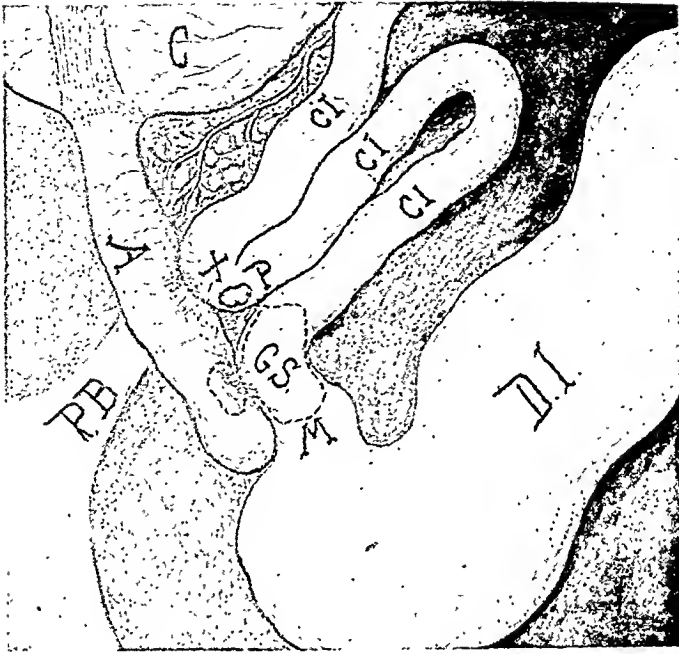
Gall-stone removed in Case II, gall-stone ileus.
Operation, Dec. 11, 1909. Recovery.

FIG. 3.



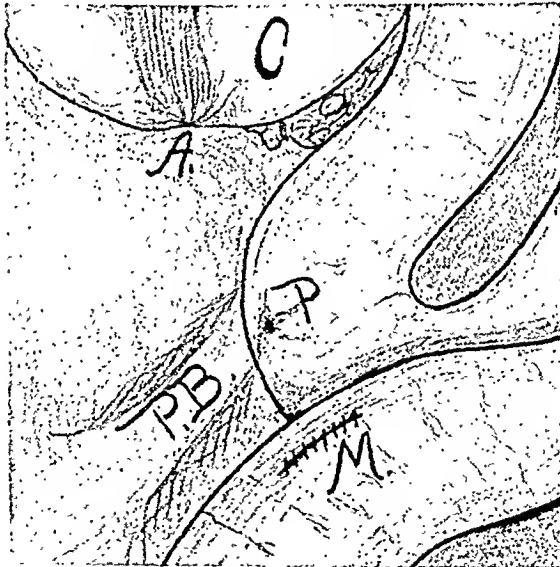
Gall-stone removed in Case III, gall-stone ileus with strangulation.
Operation, Oct. 7, 1911. Recovery.

FIG. 4.



This illustrates diagrammatically Case III, gall-stone ileus with strangulation. *C*, cæcum; *A*, appendix; *CI*, collapsed ileum; *DI*, distended ileum; *PB*, pelvic brim; *X*, ileum kinked and adherent at point of obstruction, *M*, and partially separated to show perforation, *P*; *M*, point of obstruction, appendix and ileum perforated by gall-stone, *GS*

FIG. 5.



The condition after the stone was removed and the anastomosis closed, and the appendix taken away. *C*, cæcum; *A*, appendix removed; *P.B.*, pelvic brim; *P*, perforation at *P* closed; *M*, perforation at point of obstruction closed.

lower ileum and the bulbous appendix, with the third loop of the ileum caught over the mass by a localized peritonitis, and the second anastomosis found in this loop of ileum. Operation October 7, 1911. Recovery.

Mr. S. M., married, aged thirty-six, farmer. There is nothing in the past history that bears upon the present condition. Present illness began October 2, 1911, with severe vomiting; this became expulsive in character and later stercoraceous. Abdominal pain, which was a pronounced symptom, was controlled by morphia, which was given by the doctor. Bowels did not move from Monday until Friday, when there was a slight movement, resulting from high enema. He was brought to Baltimore on Friday, and was first seen by Dr. H. B. Thomas. He was given castor oil and an enema, but these were not effectual; his vomiting was still voluminous and markedly stercoraceous, and, as the intestinal patterns became apparent, I was called in. The clinical picture was that of a pronounced mechanical intestinal obstruction. The man was exhausted from persistent vomiting; he had a small pulse, not very rapid; no temperature; and the facial expression was that of pronounced exhaustion. The abdomen was markedly ballooned; and in the upper abdomen visible coils of intestine were noted. At the time that I saw him peristalsis was visible in these patterns. He was a slender man, with thin abdominal walls, and this was easily seen. A diagnosis of advanced obstruction was made, and he was sent to the Union Protestant Infirmary.

Operation.—This was performed within an hour after I first saw him. Low right rectus incision made; greatly distended and congested loops of small intestine came into view, and a quantity of murky, bloody serum welled out. The ballooned intestines were packed off (in order to keep the intestines within the abdomen, as evisceration of the intestines adds so largely to the element of shock); the cæcum was found to be collapsed, as was the ileum in the immediate neighborhood of the ileocæcal valve. A hand was passed down in the iliac region, and a hard (stone-like) mass was palpated. It was about the size of a small apple, and adherent below the brim of the pelvis, just over a little to the outer side of the right iliac vessels. This mass consisted of coils of small intestines tied together by adhesions, due to local peritonitis, with a hard mass in the lower ileum, which proved

later to be a gall-stone. This was the point of obstruction, as likewise the point of strangulation, in the segment of bowel distal to the point of blockage. The small intestines proximal to this point were greatly distended and congested, while distal to the point they were collapsed. On separating adhesions a loop of ileum, about six inches from the ileocæcal valve, was freed, and an opening was noted in it (as shown by Fig. 4). This communicated with the centre of the mass by an anastomosis. The opening in this first loop was closed with purse-string sutures of fine silk, and the loop tucked aside. In continuing the separation of the adhesions, over and around the mass, a large anastomotic opening was found between apparent adjacent coils of ileum. In this anastomosis was found a large gall-stone, lying partly within the ileum and partly within what proved later to be a bulbous appendix. This point of blockage was 18 or 20 inches from the ileocæcal valve. An ulceration had occurred, making this opening between the ileum and the appendix, and a local peritonitis had caught this above mentioned third loop, perforating it. In consequence of this inflammatory process angulation took place, and complete strangulation of the bowel at the point distal to the blocking occurred. The appendix was gotten up and removed. The opening in the ileum could not be attended to while it was tied to the side of the pelvis by dense adhesions and so deeply placed. By freeing the adhesions, the loop was gotten up, and the strangulated segment freed (it appeared as though constricted by a tight band). The opening, which was over an inch long, was closed with a running suture, and a few interrupted Lembert sutures were placed over this, thus completing the closure. The lumen of the bowel was not diminished at this point. Some contamination occurred before this opening could be closed. The zone of strangulated bowels seemed to be sufficiently viable not to interfere. After releasing the strangulation and closing the opening, the lumen seemed to be re-established, as noted by the contents of the ballooned portion passing into the collapsed portion. In view of the contamination, pelvic drainage was deemed expedient, and a rubber tube, the size of my little finger, was placed in the pelvis, along with several iodoform rubber tissue tucks. The abdomen was closed except at the lower angle, where the drainage came out. The

patient was somewhat shocked; 700 c.c. of salt solution was given under the breast during the operation.

After History.—The vomiting stopped at once, and the following morning his condition was favorable—pulse 80, normal temperature, and draining well. In order to overcome the toxæmia, which was the chief feature in the case, he was given continuous salt solution, placed in the Fowler position, and nothing allowed by mouth for thirty-six hours. He made an uneventful and uninterrupted recovery.

History.—Gall-stone ileus, although rare in its occurrence, is an old subject. Bartholin,³ in 1654, published a case of perforation of a gall-stone from the gall-bladder into the jejunum. Many interesting cases have been reported since that time. Murphy,⁴ in a recent article, divides the subject into two distinct periods—first, that which precedes the appearance of the epoch-making article of Courvoisier in 1890, and second, from 1890 to the present time. In the first period gall-stone ileus was distinctly in its infancy, but since 1890 it has been purely within the border-line of surgery. Courvoisier justly deserves credit for having directed surgical endeavor in the proper channels. His work was indeed a masterful production. The forcible way in which he presented its various problems having to do with gall-stone disease in its various locations gave him world-wide recognition. He is credited with having done the first successful pioneer work in common-duct stones, having performed three successive, successful operations in 1890. His book, with its voluminous statistics, has been quoted more generally than any other; but I think he is probably best known by the law which is given his name—Courvoisier's⁵ law. The law briefly stated is as follows: "When the common duct is obstructed by a stone, dilatation of the gall-bladder is rare; when the common duct is obstructed by other causes dilatation of the gall-bladder is common."

The truth of this law is far-reaching, and it is one of the most certain in surgery. Its chief value lies in that it dis-

tinguishes the curable from the incurable, the operable from the inoperable, the lithogenous from the non-lithogenous cases. Cabot,⁶ in 1901, called attention to the wide-spread neglect of it; and stated that it was curious indeed that a law of such value should have been so slow in penetrating the minds of American physicians and surgeons. This was shown by the fact that most American writers on medical and surgical aspects of disease of the gall-bladder either made no reference to the facts emphasized by Courvoisier, or made statements directly contradictory to that which had found general acceptance in England and on the Continent.

The monumental works of Langenbuch, along with Naunyn, Kuemmel, Riedel, Kocher, Fenger, Mayo Robson, and Treves, have added so much of value that they must not be overlooked.

Frequency of Occurrence.—This form of obstruction, as compared with other causes, varies markedly according to the statistics given by the various authors: 1 to 15 (Fitz); 1 to 28 (Lichtenstern); 1 to 17 (Gibson). Mayo Robson⁷ states that in the four largest hospitals in the United Kingdom, for a period of twelve months, in the 80,000 in-patients and several hundred thousand out-patients, there were but four cases of intestinal obstruction due to gall-stones. Records of the Johns Hopkins Hospital, together with the Union Protestant Infirmary and St. Agnes, show that out of a total of 280 cases of obstruction, there was found but one due to this cause (Bloodgood⁸). Barnard⁹ reports a series of eight cases from the records of the London Hospital, covering a period of eight years. These were selected from 360 cases of intestinal obstruction from various causes, making the frequency of gall-stone obstruction in this series of cases 1 to 45. Of the eight cases, three recovered and five died. An interesting fact is that in four of the fatal cases the post-mortem showed a gall-bladder-duodenal fistula between the neck of the gall-bladder and the first part of the duodenum, explaining the portal of entry of the calculus into the intestine.

In view of the varying statistics, I have endeavored to

get further data regarding the frequency of the occurrence of cholelithic obstruction. I received personal communications from a given number of prominent surgeons, selected at random, and from the 28 heard from, I was able to collect but 16 cases. These surgeons are men who have had long and active careers, and their cases are to be numbered in the thousands. It would be safe to say that each of these 28 men would number a thousand operations a year, and doubtless their experience covers at least 20 years; so that, grossly speaking, from the number of 540,000 cases there occurred 16 cases of gall-stone obstruction. Of the 16 cases, 11 died and 5 recovered, making the mortality about 69 per cent. The average age was about 55 years, agreeing with Courvoisier's statistics. From six of the leading surgeons of this city, I was able to collect but four cases. Two of the men who had had the longest and most active careers had never seen a case. Of the four collected there was but one recovery and three deaths. The figures show not only the rarity, but also the high mortality following operation for the relief of the same.

Courvoisier's statistics show that the average age is between 50 and 70. Of the three cases which I am reporting, two occurred after middle life. It occurs about five times more often in females.

Method of Entrance of Calculus into the Intestinal Tract.

—This is of great interest, as likewise is the fate of the gall-stone in the intestine. There is often found a clean history of gall-stone disease in these cases, but in the majority of the cases there is no previous history of trouble of this kind. Stones large enough to produce obstruction usually find their way from the gall-bladder into the intestine not by the natural passage. The pathological process of various entrances may be analyzed in the following way:

1. First and foremost, by the extension of the inflammation from the gall-bladder. The stone passes through the wall of the gall-bladder into some portion of the intestinal tract.

2. By being blocked in the common duct, and the extension of the inflammation continuing, ulceration forms an anastomosis between the common duct and the intestinal tract through the duodenum.

3. The same process occurring by anastomosis between the cystic duct and the intestinal tract.

4. The stone may pass through the cystic duct and the common duct on into the bladder by dilating the latter.

5. The stone may gain entrance into the transverse colon, and, if so, pass out without producing symptoms of obstruction.

The entrance of large gall-stones through fistulous openings into the intestines occurs oftener than has been suspected, and the possibility of its occurrence must not be forgotten. In fact, we must conclude that the occurrence of intestinal obstruction, after the passage of gall-stones from the gall-bladder into the intestines, is surprisingly frequent, owing to the large size of these stones. Courvoisier reports ileus in 28 of 73 cases, or 38 per cent. These openings occur between the posterior surface of the neck, body, or fundus of the gall-bladder into the first part of the duodenum, namely, that part of the duodenum which is so often bile stained at autopsies.

A gall-bladder-duodenal fistula is more frequently found than an opening in the colon or other sections. Out of 30 fatal cases, 28 were due to gall-bladder-duodenal fistulæ, and only two to gall-bladder-colon perforations (Courvoisier¹⁰). There was but one between the gall-bladder and the ileum. It is emphasized by Courvoisier that stones large enough to produce ileus with rarity ulcerate through the choledochus wall. He further called attention to the fact that at the end of the eighteenth century there were but nine cases of gall-bladder-intestinal fistulæ recorded, while three times as many cases of intestinal obstruction due to gall-stone had been reported. This fact shows the unsuspected frequency of associated inflammatory and ulcerative processes in many of these cholelithic obstruction cases.

The Vagaries and Wiles of Cholelithiasis.—The devious

ways and paths through which stones have been found to wander, as exemplified in many reported cases of cholelithiasis, is most interesting, and have been the cause of much complex pathology, viz.: They have been passed through the urethra, as in a case of Elsner's.¹¹ Postmortem disclosed in this case a fistulous track leading from the gall-bladder to a perinephritic abscess, this extending to the right kidney where a stone was found, one having passed by the ureter to the bladder and on out. An abscess may continue to perforate downward, and the stones in this way perforate directly into the urinary bladder. Courvoisier reports seven cases of urinary fistulæ associated with gall-stones. Barroud¹² reported a case where 200 stones passed the urethra within eight days, and the patient recovered. Naunyn reports a case in which Mikulicz operated for pyloric stenosis, which was supposed to have been caused by an ulcer. A large gall-stone was found forming the base of the ulcer. Morgagni¹³ reports a case in which the common duct was dilated to the size of the stomach, and filled with stones. Such enormous dilatations of the common duct may readily be mistaken for pancreatic cysts—all the more so, on account of the topographico-anatomical relations of the common duct to the pancreas, and also from clinical experience secondary affections of the pancreas have been proven to depend upon gall-stones.

Numerous cases have been reported where they have ulcerated into the stomach and have been vomited up. Case 124 of my series exemplifies and explains the pathology of this condition clearly.

CASE 124.—Mrs. M. E., age 43. Operation, Oct. 21, 1909. She had trouble referable to this region off and on for many years. Operation disclosed an anastomosis between the gall-bladder and the stomach, showing that a gall-stone later would probably have anastomosed through the ulceration into the stomach. This case explains the condition found in those cases on record where gall-stones have been vomited up.

Diverticula back of the head of the pancreas have been found to contain stones, passing out from the cystic duct.

Diverticula in the intestines have been their hiding place. There may be a lodgement in the intestine at the site of a malignant growth, or in the appendix of the smaller stones. An abscess in the thigh of a woman revealed them (a case of Porges), and so on. In Case 27 of my series there was a biliary fistula opening on the abdominal wall.

CASE 27.—P. M., age 67, male. Operation, Oct. 21, 1904. He had had a biliary fistula opening on the abdominal wall for 14 months. There was a continuous discharge of bile, and at various intervals a number of gall-stones had worked their way out. Operation disclosed a stone in the common duct, as well as others in the gall-bladder. Cholecystectomy was done, with recovery of the patient.

So it is readily seen that the fate of the gall-stones in the intestines varies. I have mentioned above some of its vagaries. Fifty per cent., after long-standing obstructive symptoms, pass per *vias naturales*. The rest, after varying intervals, with repeated recurring attacks, depending upon the advancement of the stone, become finally arrested, and, if not relieved, generally produce perforation and peritonitis.

Numerous cases have been reported to me where they have been passed spontaneously. I am incorporating one case, as given to me by Dr. H. C. Algire, of Baltimore, which is of interest at this point:

Patient was a short, stout woman, age 72. She had an acute onset of severe abdominal symptoms of the complete obstruction type, after having given a history of mild obstructive attacks for a number of months preceding. Her condition grew desperate, and her life was despaired of. After ten days of complete obstruction, while she was lying in a stupor, the bowels moved copiously, and it was seen that a large gall-stone was passed. She gradually returned to consciousness and recovered. She lived five years after this, without further evidence of this trouble.

The 'Site of Impaction.'—In all of the reported cases it seems to be borne out that the principal location where the stones are blocked and produce ileus is in the lower ileum, that is, the greatest percentage is found in the lower ileum. Courvoisier's analysis of 52 cases shows this very clearly, as well as the other points of impaction:

Blow
Duode
Jejun
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INTESTINAL OBSTRUCTION DUE TO GALL-STONES. 737

Duodenum	3	
Jejunum	4	
Upper jejunum	1	
	—	8
Upper ileum	4	
Middle ileum	1	
Ileum	18	
Lower ileum	10	
	—	33
Ileocæcal valve	7	
Vermiform appendix	2	
	—	9
Sigmoid flexure	2	
	—	2
	—	52
Total		

Manner in which Obstruction is Produced.—In gall-stone ileus there is either partial or complete interference with the onward movement of the contents of the bowel. In the former there will be well-defined symptoms of obstruction which may or may not be severe in character. As the movable mass finds difficulty in its progress, or produces further spasm of the intestinal wall, these attacks of ileus are repeated. It should be remembered that the interior of the small intestine, unlike the colon, is covered with the folds of the valvulæ conniventes, so that a large, rough calculus, with angular surfaces, is apt to meet with difficulty in finding its way along such a canal; which difficulty is further increased, due to the anatomical fact that the small intestine becomes narrower from its upper to its lower end. These attacks recur with greater violence until the stone passes the ileocæcal valve and escapes per *vias naturales* or else becomes arrested in the lower ileum, the most common seat of complete blockage. It is with this form of gall-stone obstruction that the present paper is alone concerned. As a rule, calculi produce intestinal trouble within a few days after reaching the intestine, but as to the time obstruction may come on after the stone enters, it is

purely speculative. Cases have been reported where the stone was assumed to have remained in the bowel ten years (Eve's), reported by Treves.¹⁴ Mayo Robson cites a fatal case where the stone weighed only 55 grains.

The common type of gall-stone ileus is usually unassociated with strangulation, and in the majority of cases reported it is clearly understood that there is an impaction of a large concretion in some part of the intestinal tract, producing a mechanical block. In a given case, however, we may have three varieties of ileus:

1. Adynamic: due to a paralysis, from some cause, of the peristaltic wave of the intestine.
2. Dynamic: which depends simply upon the failure of the abdominal wall to overcome the resistance offered. The spasm beneath and around the calculus is the chief cause of the obstruction.

Mechanical: (a) obturation ileus, which is an arrest from blockage of the onward movement of the fecal current; (b) strangulation ileus, which involves not only the arrest of the intestinal contents, but the arrest or interference with the circulation in the bowel segment involved. The bowel soon loses its viability, as is shown in Case 3, of my series. Inflammatory changes in the lumen rapidly occur, and, consequently, these cases are much more rapidly fatal than in the obturation type of mechanical ileus.

Extensive research work in this field, done by Bouchard, Albu, Clairmont, and Ranzi, in connection with the cause of the mortality in these cases, points to auto-intoxication as the prolific cause, and they are of the opinion, with Kukula,¹⁵ that the reflex theory of the symptoms of ileus is no longer tenable. They are strongly of the opinion that the symptoms of collapse and depression are entirely due to auto-intoxication. There are others, however, who hold strongly to the belief in other elements as the cause of these deaths.

Symptoms of Intestinal Obstruction.—The clinical history may or may not show evidence of pre-existing gall-stone disease—cholecystitis, stone in the various ducts, etc. In a large percentage of the cases, however, the history shows some evi-

dence of disturbance in this region. The symptoms of tenderness and pain associated with fever may have occurred at some previous time, incident to the ulcerative process at the time of the escape of the stone from the gall-bladder. In many cases no such symptoms are elicited, and in others only vague symptoms of colic, bilious attacks, etc., which have occurred through a period of a number of years previous to the onset of the obstruction, with or without jaundice.

When the ileus occurs there is always present in the picture the cardinal signs which embrace a definite syndrome of symptoms, consisting of pain, nausea, vomiting, coprostasis, and tympany. In all out-spoken cases these are present, one or more varying in intensity with each individual case. There is a history of gradual, rather than sudden, onset, unless the point of blockage is high up in the ileum or jejunum. In such cases there is sudden onset, associated with intense pain and marked peritoneal shock, and early fecal vomiting, without much distention. Pain is the most conspicuous, most common, and most pronounced symptom of the group. It is always severe and constant. It is of a colicky character, subsiding at times and then recurring, as the fatigued intestinal muscles recover their peristalsis and make further efforts at expulsion. Although always pronounced, it is not as severe as the pain that accompanies strangulation. The pain is due to the tension and torsion of the nerves of the mesentery (Lennander¹⁶).

Vomiting is persistent throughout. It appears at the beginning of the attack and continues uninterrupted until the obstruction is relieved. The higher up the obstruction, the more marked the vomiting, the more incessant, severe, and copious. In a short while it becomes stercoraceous, which is not due to the reversed peristalsis as was formerly thought.

In a complete attack of ileus, there is complete arrest of the fecal current. This is absolute as far as the passage of feces and gas is concerned. This condition is interpreted in a very confused way; by many it is thought that if a high enema brings some results, there cannot be an obstruction. This often is the chief cause of delaying operations.

Local tenderness is not, as a rule, elicited by pressure of the examining hand, as in cases of obstruction from other causes. It is chiefly of use as an aid in cases of peritonitis. Limited tenderness may appear and be of some diagnostic value. The blocking stone is seldom palpable. Diffuse tenderness generally means the onset of peritonitis. In most cases the evidence gained by the examining hand is of much importance, as it aids in the differential diagnosis.

The stiffening of the belly muscles and the marked universal spasm and rigidity which is noted in peritonitis are generally not noted in acute intestinal obstruction. Tympany and meteorism are markedly pronounced in some cases, but usually not so marked as in acute strangulation types. When visible peristaltic loops are seen, they are of great aid and point very clearly to mechanical obstruction, as there is generally an absence of visible peristalsis in peritonitis. There is usually an absence of temperature, and high leucocytosis is present. X-ray examination up to the present time is of no special value.

Many cite with confidence an array of symptoms which points to the diagnosis of gall-stone ileus, but, for my part, I think that we can only suspect from the symptoms a possible gall-stone ileus, and that we cannot diagnose with certainty a case of this kind.

Differential Diagnosis.—The diagnosis of gall-stone ileus is seldom made with certainty. Many acute cases, having to do with gall-bladder surgery, simulate obstruction very closely. This occurs in the experience of every operator. Acute gangrenous cholecystitis, acute empyema of the gall-bladder with pericholecystitis, acute common-duct obstruction—in many such cases I have seen all the symptoms of acute obstruction, which immediately cleared up following operation for the relief of same.

Many acute conditions of the abdomen have to be considered in the cases that present themselves: peritonitis from its various causes, obstruction in the ureters, acute pancreatitis, acute torsion of an ovarian pedicle with its inflammatory symptoms, acute appendicitis, etc. So that many times the best that we can do is to recognize early that there are obstruc-

tive symptoms, and not waste time in speculation as to the cause but give surgical aid as promptly as possible. There is no condition in surgery so imminently calling for early help as intestinal obstruction from any cause. Although it is stated that in 50 per cent. of the cases the stone is passed spontaneously, one assumes a highly dangerous supposition when he assumes in a given case of stone obstruction that they will adopt that course, and in consequence a waiting or expectant plan of treatment is resorted to with the probable loss of the patient's life and the late operation credited with the mortality.

Mortality.—The disease is a peculiarly fatal one. Out of 280 cases collected by Schuller (of Strasburg), Dufort, and Courvoisier, 156 died. Other statistics place the mortality at about 50 per cent. The mortality after operation has been in the past very high, due, I gather, to the late resort to surgery. Naunyn makes the statement, after considering the results of 13 operations for ileus due to gall-stones of which number there was only one recovery, that laparotomy is not to be recommended. Langenbuch, on the contrary, took a different view. He made the unqualified statement that gall-stone obstruction is a surgical disease, the treatment of which is to be intrusted to the physician only during a very short period.

The statistics give varying figures as to the mortality following operation. Lobstein found out of 31 cases operated upon a mortality of 61 per cent.; Courvoisier out of 125 operations found a mortality of 44 per cent.; Schuller found out of 82 cases of operation a mortality of 56 per cent. Korte is reported to have saved four out of five consecutive cases. The present-day statistics that I have collected, unfortunately, still give a high percentage of mortality, namely, 69 per cent. The advanced age of the patient, the fact that the operation is undertaken as a last resort, and the long-standing auto-intoxication are the chief reasons for this high mortality. It varies within such wide limits, however, as to make it impossible to draw any conclusions of value. Suffice it to say, that the mortality is always high, for the reasons mentioned,

and is unquestionably highest in the hands of those surgeons who operate late. I wish to emphasize that this high percentage of mortality at the present time should be considered a disgrace, although the surgeon is not responsible for it. The mortality from operation should be *nil*, and will be *nil*, if the internist in the future will have his cases operated upon early, and not let them drag through repeated attacks of obstruction until they are practically all-in, before surgical aid is sought.

Operation.—This is our only means of correcting the difficulty, and so should be given as promptly in each individual case as possible. Delay in this condition is more fatal than in any other lesion. General anæsthesia is to be preferred when the condition warrants it; if not, a local anæsthetic may be used. The incision is usually placed in the right or left rectus, and the obstructing point sought with as little evisceration as possible. If the loop can be brought up to the surface, the bowel should be opened and the stone removed. The question of pushing the stone onward is usually not feasible, and it is far more dangerous than delivery of the stone through a longitudinal or transverse incision in the bowel wall. The putrid contents of the distended loop should be emptied preferably through a Monk's tube. This obviates in many cases the fatal issue, by doing away with further absorption of the decomposing, retained products. This is an important point, and should be made use of invariably. From personal communications that I have received, the cause of death in their cases has been attributed to neglect of this point. The opening in the bowel can be easily closed by a Connell and Lembert suture, and the bowel dropped back into the abdomen. If the segment of bowel at the point of obstruction is still viable, this is all that is needed; if not, a resection will have to be done, and either an end-to-end or lateral anastomosis be made. Drainage is needed, in my opinion, if there has been much soiling of the abdomen at the time of the operation and if the peritoneum contains much bloody fluid. I regard this as important, and usually make use of rubber tube drainage, placed well into the pelvis, and the abdomen closed around it. The

patient should be put in a Fowler's position, and proctoclysis begun as soon as the patient is returned to bed. These steps have been made use of in the three cases presented.

I wish to emphasize this point—that the toxæmia in these cases is the chief factor to be combated, and we can do this best by thoroughly washing the stomach before operation, thoroughly draining the distended loop above the obstruction at the time of the operation, and giving freely and abundantly salt solution both at the time of the operation and afterwards—intravenous if necessary, or intracellular in all cases, along with salt solution by rectum. I believe if these steps are followed, more lives will be saved, even if the operation is resorted to late.

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A NEW DECOMPRESSION OPERATION FOR THE BRAIN.

BY WILLIAM H. HUDSON, M.D.,

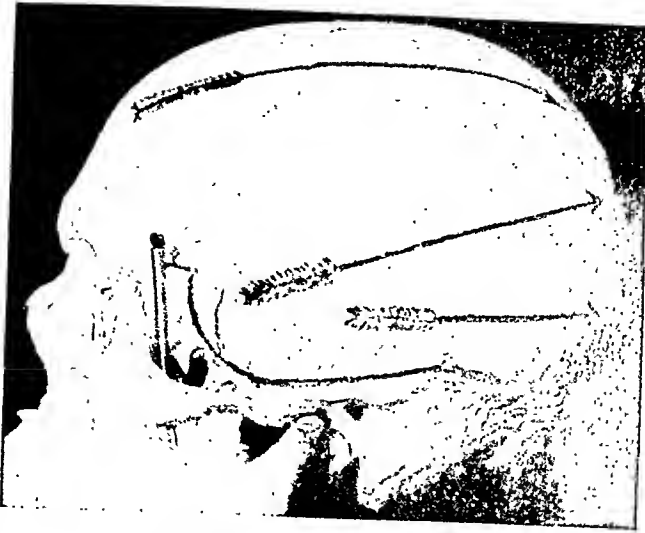
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NOTWITHSTANDING increased knowledge of cerebral localization and improved technic in brain surgery, the number of palliative operations is constantly increasing. These decompression operations not only preserve the sight but ameliorate other distressing symptoms, and may give the neurological surgeon additional time for the localization of the tumor, and perhaps its surgical removal. Moreover, decompression of the brain as a therapeutic measure is daily increasing, many conditions of the brain demanding this operative procedure other than tumors.

In Great Britain the customary decompression operation has been the making of a large permanent opening in the skull, preferably over the so-called silent areas in the brain. As the dura is generally opened in such cases, nothing but scalp is left to protect the brain, and the increasing intracranial pressure soon produces an immense hernia of the brain; with damage to the protruding part, even to the extent of destroying its functions. Later the protrusion may become so large as to rupture the line of union in the scalp, a most distressing and undesirable condition.

On the Continent, many surgeons make the usual trap door in the skull, and replace it, allowing the pressure to force it out, and thereby have all the undesirable conditions found in the British method. In the United States, the subtemporal method is much used; the protruding brain is controlled better by the layer of muscle and fascia in addition to the scalp which covers the protruding mass. Otherwise the brain is damaged in being forced out through the circumscribed opening in the skull, and as I have seen in several cases, a paralysis promptly appears on the opposite side, due no doubt to dis-

FIG. 1.



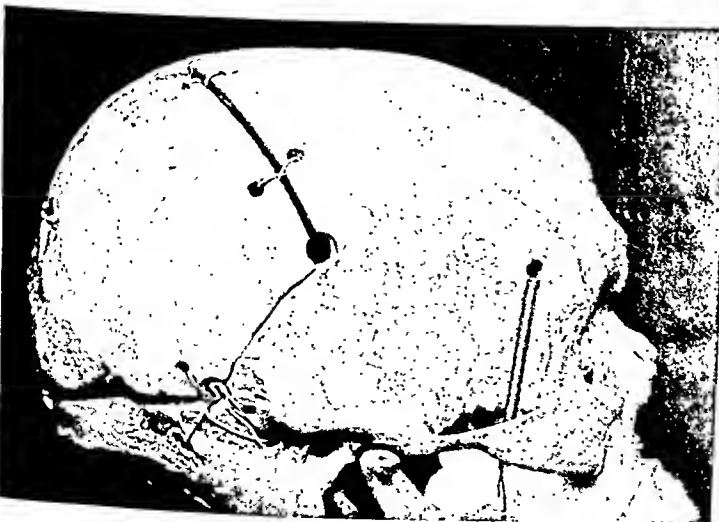
Arrows show direction in which entire hemisphere may be displaced.

FIG. 2.



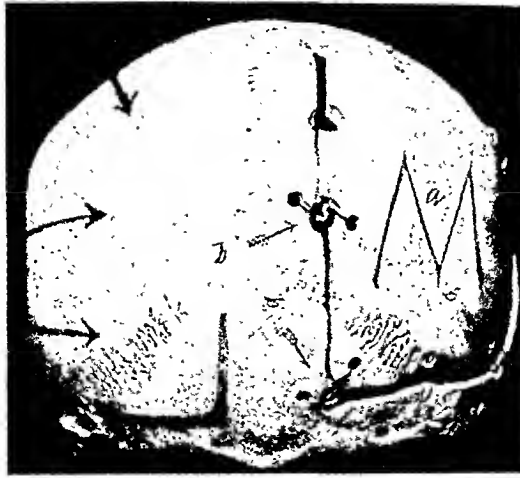
Decompression flap when a tumor is unlocalizable, and no effort made to reach it. The expanding silver sutures show straightened out. *a*, shows the W-shaped incision in the dura.

FIG. 3.



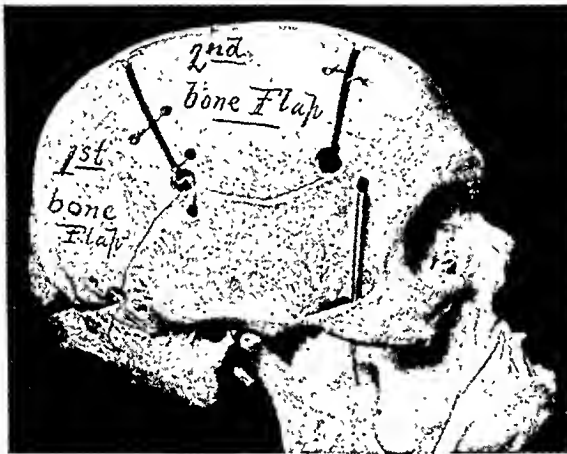
Shows the decompression bone flap replaced by the looping of the expanding silver sutures.

FIG. 4.



Shows the posterior view with three expanding sutures shown looped.

FIG. 5.



Shows the two bone flaps as made when the operative point is in the motor region or in front of it. This also shows the two flaps looped down. Also represents the exposure of the brain in operations for apoplexy.

FIG. 6.



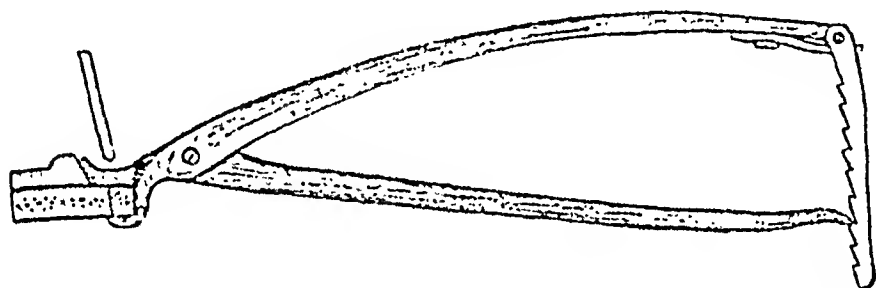
Shows the limit of expansion when two bone flaps have been made.

placement of brain substance into and toward the opening in the skull, which is smaller than the hemisphere.

To obviate the local damage sustained by the brain in being forced out of a circumscribed opening in the skull, and to prevent a later hernia of the brain and the possible tearing asunder of the scalp wound and to allow the restoration of the calvarium should a cure be established, a new method of decompressing the brain has been carefully worked out, and is as follows:

NEW METHOD OF DECOMPRESSING THE BRAIN.—Fig. 1 shows the direction in which the entire cerebral hemisphere can be displaced without damage to any local areas. *This*

FIG. 7.



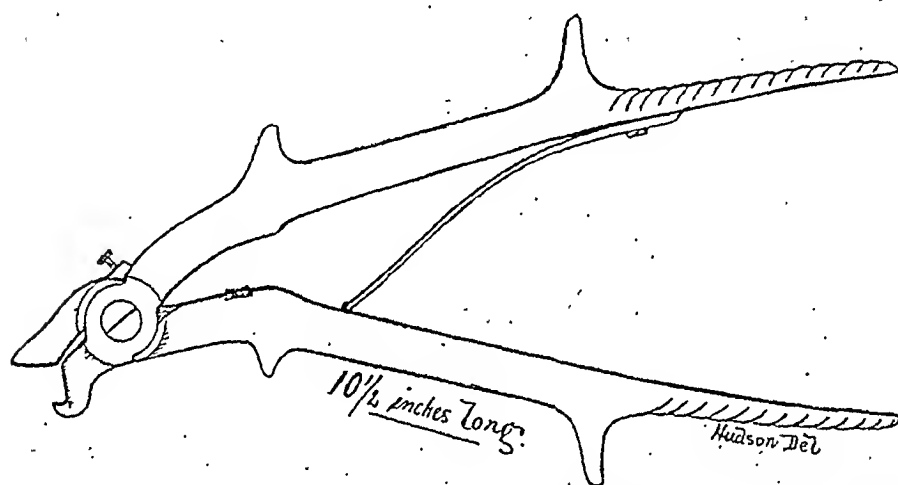
The drill guide is shown grasping the bone and locked. The lower blade is cupped for receiving the drill point, and protects the brain and dura. The upper blade pushes the scalp aside and guides the drill as it penetrates the bone. The lower blades will pass into the trephine opening, and the round shank of the blades will move freely in the channel cut in the making of the bone flap.

fact is the chief point in the operation. In those cases of unlocalizable brain tumors where the decompression is necessary, the area exposed is the entire posterior portion of the brain, so that the entire hemisphere may be displaced backward, thus avoiding localized damages. The lower limit of this flap is the lower limit of the cerebral hemisphere behind, its upper limit is where the skull begins to curve in a downward direction. The fissures and convolutions of the brain are not considered. If the growth has been localized in the motor region and not removed the second flap is made over the posterior portion of the brain, thereby making two flaps as indicated in Fig. 5. The same process is applied to the left side of the brain, the greatest care being used not to injure the cortex.

Technic.—A special surgical armamentarium is necessary, as the work must be done quickly and easily, without shock or jar to the patient or fatigue to the surgeon's hands, self-stopping trephines and two-hand forceps being absolutely necessary. Other instruments to expedite and simplify the operation are demanded, such as drill guides, bevel forceps, and spooned brain spatulas.

The ordinary decompression operation over the posterior region of the hemisphere is done after the method herein de-

FIG. 8.

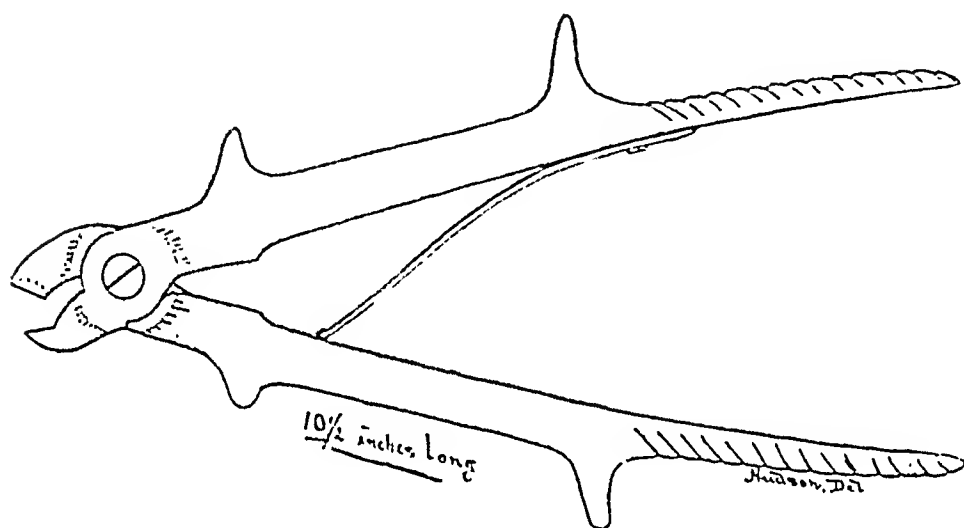


Hudson's two-hand channel-cutting forceps. With these forceps two bone flaps representing 15 inches of channel can be cut in the densest and thickest skull in three or four minutes, without shock or jar to the patient, and without fatiguing the surgeon's hands.

scribed in detail: The head is shaved just before the operation, and a strong rubber tourniquet applied as low on the head as possible. The writer's usual osteoplastic flap with short central bevel is rapidly made. Two openings are made in the free border of the flap, three-quarters of an inch apart. These openings are united by the smallest size Gigli wire saw, making a cut on a bevel. The other holes are united by the writer's two-hand channel-making forceps. Opposite the primary trephine openings the skull is firmly grasped with the drill guide and small $\frac{1}{8}$ inch openings made for the silver wire sutures. The flap is now broken back by inserting elevators under its anterior and posterior borders. If the base does

not break readily it is weakened by cutting a short channel under the scalp from either side toward its centre by the writer's under-cutting forceps. Silver wire of eighteen or twenty gauge is twisted carefully but quickly into the openings opposite the bone flap. These wires are left six or eight inches long so as to be readily inserted into the drill holes in the bone flap. The dura is now opened, leaving a broad margin around the edge by an M- or W-shaped incision (Figs. 2 and 6), great care being taken not to injure the cor-

FIG. 9.



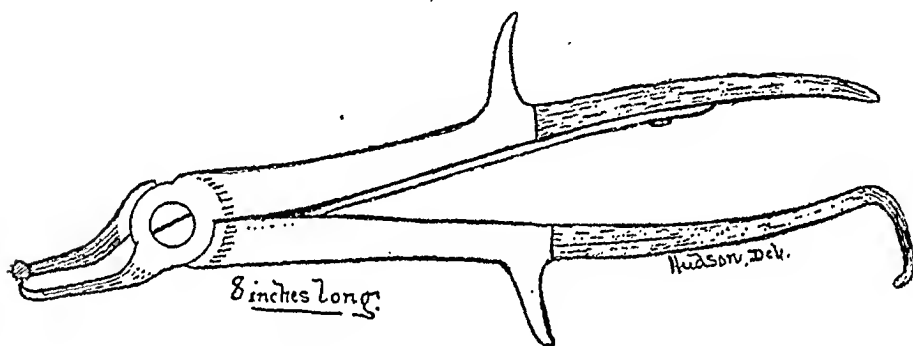
Hudson's cerebellum forceps for the permanent removal of bone over the entire cerebellum when an osteoplastic flap is not considered. This forceps may be used for cutting away the inner edge of bone in decompression operations so that the edge of bone will not injure the brain as the brain is extruded through the opening.

tex. The silver wires are now inserted into the drill holes in the bone flap and twisted, allowing about half an inch of slack. Each of the wires are then caught with artery forceps and twisted down until the bone flap fits snugly over the brain. The scalp is then closed carefully with interrupted fine silk sutures. The fitting back accurately of the bone flap prevents œdema of the brain, and yet all the benefits of a decompression operation are secured.

Should the tumor continue to grow, the bone flap is gradually lifted as the pressure straightens out the loop in the silver wire. Should pressure symptoms reappear and the

bone flap not be lifting, a sharp stylet may be inserted through a cocainized point in the scalp, and the bone flap given a lift. This may be continued until all the loops in the silver sutures have been straightened out. The limit of the expansion of the skull is reached before the scalp gives way, which may have taken months or years. In the meantime, if the surgeon has found and successfully removed the tumor, the decompression bone flap may be replaced by twisting the loops again. If the tumor has not been found and has continued to grow, all the relief possible has been obtained from the decom-

FIG. 10.



Hudson's special beveling forceps for removing the inner edge of bone in all decompression operations. This applies to the subtemporal, and the ordinary decompression operation where nothing is left but the scalp; and as well to the writer's method. By beveling the inner edge of bone much less damage is inflicted on the brain substance, as the pressure forcibly extrudes it through the opening in the skull. In the writer's method of decompression, this danger is not a serious one, nevertheless the internal sharp edge of bone should in all cases be carefully removed.

pression, and the disadvantages of the old methods of decompression have been obviated.

It is the writer's practice to cut off the sharp inside edges surrounding the bone flap. This is best done with his two-hand cerebellar forceps, or with his special bevel forceps, shown in Fig. 10.

If an effort has been made to remove a tumor in the motor region, which failed, two osteoplastic flaps are made. They are fixed back in position, as shown in Fig. 5. Both of these flaps expand under the pressure of the growth. This decompression is very similar to nature's method in young children, where the sutures separate, giving a uniform enlargement of

the skull, with the advantage that later on, should the condition be cured, the section or sections of the skull may be replaced to the proper position.

The writer has found that this operation can be done quicker and with much greater ease than the subtemporal operation, where the bone must be slowly bitten away under the temporal muscle.

Many points in the technic of cranial surgery have not been touched on in this article. The writer's methods are fully discussed in "The Technic of Cranial Surgery" and in "The Technic of Operating on the Brain in Deeply Located Lesions Attended with Increased Intracerebral Pressure, especially Apoplectic Hemorrhages."

NOTE.—An entire series of two-hand forceps have been carefully worked out; not only for operations upon the skull, but for operations on the spinal cord. The two-hand principle has been found absolutely necessary for the successful performance of the work as represented by the writer's new technic especially for deeply located tumors, apoplectic clots, etc.

"LE RHUMATISME TUBERCULEUX" (PONCET).*

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RHEUMATISM is not a disease, it is a term covering certain clinical manifestations caused by various toxi-infectious agents.

The search for a specific cause has led to the partial dismemberment of acute rheumatism. Gonorrhœal rheumatism, the first child from the loins of this time-honored parent, was born in great travail. Petronne and our fellow member Dr. Kammerer, had the honor of proving the genetic relationship between gonorrhœa and gonorrhœal arthritis. Clinically, gonorrhœal rheumatism is accepted as an entity; we also recognize a diphtherial, a pneumonial, and scarlatinal rheumatism, yet tuberculosis, the commonest of all toxi-infectious diseases, we hold as blameless.

If during the course of a gonorrhœal arthritis, a patient has a spontaneous attack of acute rheumatism, we assume it to be gonorrhœal in nature. If this is so, Poncet says, it is just as reasonable to assume that articular manifestations arising in tubercular cases may be of a tubercular nature.

Poncet and his pupils of the Lyons School hold that tuberculosis is a very common cause of rheumatism, advancing bacteriological, pathological, and clinical proofs. As surgeons it is our bounden duty to give Poncet's views our serious attention; subject them to the chastening hand of practice, and then accept or reject them.

History.—Bonnet in 1845 called attention to the transformation of rheumatic joints into true "white swellings." The medical writings of this period convey the impression

* Read before the New York Surgical Society, February 14, 1912.

that the clinicians were aware of an ill-defined relationship between chronic rheumatism and tuberculosis.

In 1854, Charcot crystallized these views, calling attention to the great mortality from pulmonary tuberculosis among patients suffering from chronic rheumatism. Again, in 1864, he emphasized the important part that scrofula played in the family history of patients suffering from chronic progressive rheumatism, and remarked on the slowness with which phthisis developed in such cases. Fuller, in 1860, in a series of 110 cases of arthritis deformans, found that 23 per cent. had lost either a father, a mother, a brother or a sister by phthisis. In 1874, Gubler, a pupil of Powell, wrote a very interesting thesis, "Pseudo-articular Rheumatism Occurring in the Course of a Tubercular Diathesis." His findings were promptly ignored.

Scattering observations by Laveran, Pollossom, and suggestive hints by Molliere and by Mauclair have an historical value when viewed in the light of Poncet's investigations. In 1892, Grocco, the Italian clinician, reported nine cases of "Pseudo rheumatismo articolari tubercolosi" and commented on the uselessness of the administration of salicylates in such cases. He considered the tuberculosis to be secondary to the rheumatism.

Poncet's personal communication entitled "Pseudochronic Tubercular Rheumatism," was presented to the French Surgical Congress in 1897. His investigation of the subject began in 1896.

Poncet's views met with great opposition, the existence of a tubercular rheumatism was stoutly denied. Patient and painstaking accumulation of laboratory and clinical facts with their careful presentation before numerous French societies has stimulated a clinical interest in the subject. Without a personal study of the literature, it is impossible to realize the amount and the extent of the work covered by Poncet and his pupils. I think it can be fairly stated that tubercular rheumatism has won a foothold in France. In this connection it is interesting to note that Tixier has given an excellent summary

of tubercular rheumatism in the *Précis de Pathologie Chirurgicale*.

In Germany the opposition is still marked. The subject of tubercular rheumatism was presented before the Northwest German Surgical Society (1910) by Muller and aroused a lively discussion; Muller, though not agreeing with all Poncet's teachings, held that his work contained some pregnant truths which required further consideration.

Prior to last year, the English literature contained no satisfactory exposition of Poncet's views. There were a few isolated references such as Edsall's, Lavenson's, and Weber's. In 1910, Prof. Alexis Thomson, of Edinburgh, read a paper entitled "*Le Rhumatisme Tuberculeux*." This paper gives a clear and accurate résumé of Poncet's views. Thomson offers no decided opinion, but says the subject is worthy of the most serious consideration.

In the course of our academic and clinical training, we have gradually absorbed certain individual mental pictures of what tuberculosis is and what it does. When we call anything tubercular our mind naturally recalls the histological picture of tuberculosis with its tubercles, its giant-cells, its bacilli, and the other points which go to make the microscopical diagnosis. In other words, tubercular tissue gives a specific microscopical picture. Now, we must ask ourselves, can the tubercular bacillus or its toxins produce other lesions? It is a well-known fact that the tubercular bacillus and its toxins do produce lesions which do not show the specific picture and which cannot be distinguished from those of the ordinary chronic inflammation, yet these lesions can often be proved by clinical or experimental means to be tubercular in origin. Pathology has demonstrated that tuberculosis can produce amyloid degeneration of kidneys, sclerosis of pancreas, and other well-known lesions; yet the tubercular bacillus cannot be demonstrated in these organs.

Poncet claims that there are a great many lesions in which we cannot obtain the specific picture, and to these lesions he

gives the name inflammatory tuberculosis, in order to distinguish it from specific tuberculosis. Briefly, Poncet's conception is, that tuberculosis is not one in its manifestations. Beside producing a specific picture, it can produce the signs of an ordinary inflammation, such as congestion, exudation, sclerosis, etc., and these signs have nothing specific about them, but are the same as the result of any ordinary inflammation.

Tubercular rheumatism is then a manifestation of tubercular inflammation as distinguished from specific tuberculosis. Poncet uses the word rheumatism in the broad sense and does not restrict it to serous and synovial membranes, but includes many extra-articular lesions.

Nature and Pathogenesis.—According to the figures of Poncet and his pupils 5 to 17 per cent. of patients with active tuberculosis and 20 per cent. of the chronic cases have or have had tubercular rheumatism. These figures hold true for surgical and medical tuberculosis. Reversing the process and examining the rheumatic cases for tuberculosis, he finds the figures substantially the same. In this, Poncet includes those cases which were thought originally to be simple rheumatism, but which later unexpectedly developed pulmonary or other tubercular lesions. In the chronic, deforming rheumatism of old age the percentage is doubled, that is 40 to 50 per cent. of these cases can be shown to have tubercular lesions. These figures are from clinical and autopsy records, and are the result of numerous observations by various investigators. If experience proves this observation to be correct, then tubercular rheumatism will have a firm clinical basis.

The occurrence of an acute synovitis in a tubercular joint, after the injection of tuberculin, is well known; a similar reaction can be obtained in some joints supposedly rheumatic; it has also been obtained in cases which have come to autopsy, in which no tubercular lesions were found in the joint, but tubercular lesions were found elsewhere. By animal experimentation it can be shown that it is possible to produce a

serous synovitis by an intravenous injection of tubercular material, and that by the injection of certain cultures of bacillus of Koch (homogenous cultures of Arloing) the common lesions of inflammation can be produced in contradistinction to typical tubercular lesions.

Tixier says that the intimate pathogenesis remains obscure. The question is, are these lesions caused by an attenuated bacillus of Koch, or are they the result of toxins elaborated in a distant focus? Experimentation tends to show that toxins produced at a distance do not cause a sufficient irritation in the tissue; this irritation can only be produced by the adherent poisons of the bacilli. If this is true, then it is necessary to demonstrate a bacillus in the lesions of tubercular inflammation. Whether the tubercular inflammation is caused by the pure toxins or directly by the bacillus is impossible to say.

Melchior, 1910, reports a case of acute tubercular rheumatism in which he was able to demonstrate a tubercular bacillæmia. He considers this as having an important bearing on the cause of "Morbus Poncet."

Pathology.—In studying the morbid anatomy of the process, we must keep Poncet's conception of tubercular inflammation as distinguished from specific tuberculosis clearly in mind. In the acute joint lesions, if we except Laveran's rare granular form, we find the ordinary manifestations of inflammation. The synovia is congested and swollen; the cartilages show erosions and superficial ulceration; the periarticular structures are infiltrated; the joint fluid clots readily, due to the high fibrin content, and shows an intensive reaction to Arloing's and Courmant's agglutinating test.

Poncet divides the chronic cases into two classes. The dominant feature of the first class (*forme atrophique ou médullisant*) is the atrophy of the tissues concerned. Clinically this group is recruited from the ranks of the ordinary polyarthritides deformans; a few cases of osteoporosis without deformity are occasionally encountered. In the second class (*forme plastique hyperostosant*), the prominent pathological

feature is the production of new tissue. This form has two types, a dry arthritis and an ankylosing arthritis. The dry arthritis has as its prototype "*morbus coxæ senilis*," with its peripheral proliferation of osseous tissue, its capsular retraction, and consequent interference with function. It is not a bony ankylosis.

Clinically the ankylosing tubercular arthritis is met with in the spondylitis deformans of man and animals. The ankylosis may be between the articular surfaces or be caused by the involvement of the periarticular structures. Both fibrous and osseous ankylosis occur. The fibrous is more common than the osseous, but all transitional forms are met with.

CLINICAL FORMS.

ARTHRALGIAS.—The myalgias, hyperæsthesias, and neuralgias of tubercular patients are well known. These "algias" are probably caused by the tubercular toxins.

To the indefinite rheumatoid pains met with in tubercular patients, Poncet gives the name tubercular arthralgia. These pains as a rule are light, show a tendency to shift, and have a predilection for the larger joints. They may be the first warning of a latent tuberculosis, and suddenly vanish upon the appearance of an active tubercular lesion; again they may develop into a true tubercular arthritis. They are frequently mistaken for growing pains or for tubercular arthritides; this latter mistake undoubtedly accounts for some of the marvellously rapid cures of tubercular hips and spines. A knowledge of the possibility of their relation to tuberculosis is invaluable.

ACUTE OR SUBACUTE TUBERCULAR RHEUMATISM.—This form is characterized by the rapid involvement of one or several articulations, giving rise to a more or less perfect picture of an acute rheumatism; it may be primary or secondary to a visceral tuberculosis. From the nature of things the primary form is exceedingly difficult to diagnose. A grave general condition with a moderate involvement is a presumption in favor of tubercular rheumatism.

The secondary form has a variable prognostic value. In this connection it is interesting to note that there is very clear and constant relationship between the visceral and articular attacks; when one advances the other recedes. The use of the salicylates in tubercular rheumatism is not only valueless but may be harmful. In nearly all the cases which have had repeated attacks of tubercular rheumatism, the pulmonary tuberculosis is of a fibroid character and advances very slowly.

Poncet considers the following to be a typical case; it is taken from Gautier's thesis, "Primitive Tubercular Rheumatism."

A veterinarian, 50 years old; diagnosis, fibroid phthisis with a large cavity limited to right apex. Mother died of phthisis, one sister lost a child from tubercular meningitis. The patient developed an articular rheumatism at 20, in bed for three weeks; all the articulations, including the temporomaxillary, were involved; therapeutics unavailing; prolonged convalescence. Ten years later a similar attack, the same in extent, intensity, and duration. Eleven years later, a third attack of arthralgia; suddenly the pulmonary condition manifested itself, and all the articular symptoms disappeared.

Poncet cites another case in which the termination differs. The patient lived among tubercular subjects. Suddenly without any apparent cause he was seized with an acute polyarthritic rheumatism; the convalescence was greatly prolonged. When the pains disappeared, the elbow, wrist, and foot were radiographed and showed a bony ankylosis. Two years later a diffuse infiltration of the apex was discovered and the nature of the lesion confirmed by a positive seroreaction.

CHRONIC TUBERCULAR RHEUMATISM.—This is encountered more frequently in the second period of life, and may be primary or secondary to repeated attacks of acute tubercular rheumatism. Four clinical varieties are distinguished: deforming tubercular polyarthrititis; chronic polysynovitis; dry senile arthritis; ankylosing tubercular rheumatism. These may occur independently or be found side by side in the same individual.

Deforming Tubercular Polyarthrititis.—This is the ordinary arthritis deformans or rheumatic polyarthrititis most often met with in young people and not infrequently in children. Drevet met with a case in a child three years old, and

others at ten and thirteen years. Poncet gives radiographs which show that there is a certain rarefaction at the ends of the bones. For the diagnosis we must depend on the history, the seroreaction, the presence of tubercular lesions elsewhere, and the future developments.

Chronic Tubercular Polysynovitis.—In this form the toxin seems to limit itself to the synovia of the tendon sheaths and articulations; there is no bony involvement, and articular deformities are lacking. All varieties in all stages of virulence may be found in the same patient: plastic synovitis, serous synovitis; purulent synovitis, etc.

As an example of this, Poncet quotes the following case: A woman, 41 years old; mother died of phthisis, three brothers died from surgical tuberculosis, another from Pott's disease. At infancy the patient had ciliary blepharitis and glands of the neck; tubercular arthritis at eight, double synovitis of the flexors of the fingers, double synovitis of the radial sheaths, synovitis of the long extensors of the thumb; both hands, especially the left, bent toward the cubital side; added to this a chronic articular synovitis of all fingers.

Dry Senile Arthritis.—As described by Poncet, this is the type of arthritis deformans which we see in old people.

Ankylosing Tubercular Rheumatism.—True rheumatism never leads to an ankylosis. Poncet states that a spontaneous ankylosis is the result of an infection which involves the ligaments or the bones; but one structure is never involved to the exclusion of the others, and between the extremes all transitional forms occur.

It is the current opinion that gonorrhœal rheumatism presents to the greatest degree the power of producing an ankylosis without the formation of pus. Poncet challenges this; according to him many of the so-called ankyloses are tubercular, and he calls particular attention to the different varieties of ankylosis in the spinal column.

Ankylosing tubercular rheumatism is associated with a mild chronic visceral tuberculosis, rather than with an active process, and a careful search is often required to demonstrate these latent lesions. As a rule there is a tubercular family

history, or a history of prolonged exposure to such an infection; sex seems to have no influence; children are often attacked; the vertebral form is confined to maturity and old age.

There are two clinical forms: monarticular and polyarticular.

The monarticular form occurs in the larger joints, most often the hip or knee. The process of ankylosis may be rapid, without intermission; at completion all pain ceases. Again the process may be gradual but irregular, with improvements and relapses, terminating usually in a complete ankylosis.

The onset of the polyarticular form may be insidious or brusque, with chills, fever, sweating, and rapid loss of weight. Several articulations may be involved; the pain and tenderness persist for a considerable period after the subsidence of the onset; there is a great tendency for the parts to assume faulty positions, and the end result may be a fibrous or bony ankylosis.

The following cases are quoted by Poncet as being good clinical examples of the condition.

CASE I.—Male, aged 32; mother died of phthisis; no family history of rheumatism. At ten, the patient had an acute attack of rheumatism, involving all the articulations of the body. The acute stage was unduly prolonged, and the patient was left with an adducted thigh which suggested an arthritis of the hip. At fourteen he had another severe attack of acute articular rheumatism, involving all the large joints and the vertebral column. This condition persisted, and for two years the patient was a constant sufferer. In his sixteenth year the pain gradually lessened but the joints became ankylosed and deformed. The presence of a generalized ankylosis destroyed his power of walking. Two years later he had a sudden hæmoptysis, and examination demonstrated an apical phthisis.

CASE II.—A young woman, aged 32; father died of tubercular laryngitis. The patient was married at twenty-two years. Shortly after this her husband developed pulmonary tuberculosis and died eighteen months later; during this time she had taken personal care of him. Three years later she married again; four months later her second husband died of pulmonary tuberculosis. Although constantly exposed to tubercular infection, she remained in good health for three years, then without any appreciable cause she began to suffer from erratic arthralgias

of all the joints, but there were no chills, fever, or local signs of inflammation. The salicylates were of no benefit. These irregular pains continued for eight years. At the end of this period she was suddenly seized with an attack of acute articular rheumatism. After three months in bed the pain subsided, but she was left with a complete ankylosis of the elbow and wrist, and an incomplete ankylosis of the right plantar arch and knee. On resecting the elbow the bones were found to be fused together, and there was no line of demarcation; clearly showing that the irritative process had been of long standing. There was a progressive deforming ankylosis of the fingers; from time to time indefinite arthralgias and a rebellious coccydynia. These signs are not those of a classic tuberculosis, visceral or otherwise, yet there was a tubercular lesion at the right apex and she reacted to tuberculin.

Lorenz (1904) reported on the frequency of the occurrence of rigidity of the spine and its relation to pulmonary tuberculosis. The following figures were the results of investigations carried out at Bad Oppelsdorf: Of 667 cases of spinal rigidity, 174 cases (24 per cent.) had pulmonary tuberculosis. Of these 667 cases, 168 had abnormally stiff spines and of these 68 (40.5 per cent.) had phthisis. Of the 174 tubercular cases, 68 (39 per cent.) had stiff spines. According to Mosse, 70 per cent. scoliotics in the young are tubercular. These figures are taken from Senator's clinic and represent the study of 89 children between the ages of six and fifteen.

Bachmann, in reporting on the changes in the internal organs in marked scoliosis, gives the following figures obtained from the autopsy records of the Breslau Pathological Institute: In 197 cases of scoliosis, 56 cases (28 per cent.) had pulmonary tuberculosis; of these 56, 39 were recent cases, 17 old cases; in the 20 severe cases 35.7 per cent. had tuberculosis; in the 36 mild cases, 64.3 per cent. had tuberculosis.

Cotte concludes that 60 per cent. of scoliotics present manifestations of tuberculosis.

ABARTICULAR TUBERCULAR RHEUMATISM.—Having described the tubercular rheumatism occurring in the joints as articular rheumatism, Poncet uses the term abarticular rheumatism to cover the manifestations of tubercular inflamma-

tion in other tissues and organs. Pathologically, these manifestations may be purely congestive, inflammatory, or sclerotic in nature.

The fleeting character of the lesions, their wide distribution, and the mildness of the tissue reactions in the majority of the cases suggest the acting of a toxin rather than a bacillus.

Poncet takes up cardiac, pleural, cerebral, glandular, gastro-intestinal, genito-urinary, ocular, cutaneous, and tendofibrous rheumatism. To cover each individual form would lead us too far. I will confine my remarks to a few of the most important ones.

The influence of the toxins of different diseases on the nervous system would make an interesting and instructive study. Many of the foremost creative geniuses of the world have been sufferers from tuberculosis. Yet in spite of this malady, with its numerous drawbacks and discouragements, we find instead of a melancholy atmosphere an air of helpful cheerfulness. This suggests the possibility of a mental stimulation by the toxins. The neurasthenia of tubercular subjects is too well known to need comment. Hollós has suggested that the toxins derived from a hidden focus may act on the nervous system through the sympathetic. Poncet, after calling attention to the frequency of tuberculosis in patients with exophthalmic goitre, suggests the possibility of the actions of the tubercular toxins on the sympathetic system. Omitting the indefinite pains described as arthralgias, ostalgias, and myalgias, we still find numerous cases of neuralgia among the tubercular; of these neuralgias, sciatica is by far the commonest. According to Courmont and Vallery, 25 per cent. to 30 per cent. of sciatica patients are clinically tubercular and 91 per cent. of them react to serodiagnostic means. The possibility of rheumatic chorea being of a tubercular nature must be kept in mind if the patient is to receive the proper treatment.

Poncet suggests that the causes of certain indefinite car-

diac, respiratory, and digestive symptoms may have their origin in the intoxication of the pneumogastric nerves or the sympathetic system.

Ocular manifestations: The most frequent of all the ocular manifestations of tubercular rheumatism is tubercular rheumatic iritis. This is not the classical tubercular iritis. In this connection it is interesting to note that Parker (1911), in his hand-book of diseases of the eye, calls attention to the investigations relating to the possible tubercular origin of some of the forms of inflammation that attack the sclera.

Gastro-intestinal tract: A great many of the inflammatory stenosing tumor-like lesions of the pyloric region are said to be examples of tubercular inflammation. Poncet, Leriche, Mouriquand, and Leclerc have contributed reports of such cases. The latest communication is an admirable study of Charlier and Nové-Josserand. They conclude that the lesions which they have studied approach so closely those described as congenital hypertrophic stenosis of the pylorus, that it is justifiable to demand if the same pathogenesis (tubercular inflammation) does not apply to them.

Before the Tuberculosis Congress at Naples in 1901, Patella presented three cases of pyloric stenosis occurring in tubercular individuals, not caused by ulcers or direct tubercular lesions, but being caused by a fibrous inflammation of the pylorus and the surrounding tissues. Romani, in 1904, described two more cases and called the condition "Patella's disease."

Skin: According to Poncet, the cutaneous manifestations are legion. It is difficult to give a systematic account of them. He includes Bazin's disease (indurated erythema occurring in scrofulous patients), erythema nodosum, and many of the atypical tubercular cutaneous manifestations as abarticular localizations of tubercular rheumatism.

Muscles: The myalgias and fibrous muscular thickenings occurring in tubercular cases are considered as being tubercular in origin.

Fascia: Sclerosis of fascia and fibrous tissue is often suggestive of a tubercular influence. Poncet quotes the following figures: in 100 cases of campto-dactylitis, 87 were clearly tubercular, 7 probably tubercular, and 6 were free from tuberculosis, that is 87 to 94 per cent. were tubercular, and he concludes that this deformity is a veritable stigma of tuberculosis.

Many of the Dupuytren's contractions and contractions of the plantar fascia are considered by Poncet to be caused by a tubercular inflammation.

Diagnosis.—"The diagnosis is often a matter of clinical impression rather than a well-ordered deduction" (Tixier).

This impression must be verified by an accurate family and personal history, a study of the attacks, their duration, resistance to therapy, tendency to recurrence, and all other toxi-infectious agents must be excluded. The urethral secretions should be examined microscopically and the complement deviation test for gonorrhœa should be applied. All the usual laboratory tests for tuberculosis can be tried. Poncet favors Arloing and Courmant's serodiagnostic agglutination test. Close watch should be kept for any external or internal signs of tuberculosis.

To sum up, Poncet says: "In the presence of rheumatism, the first thing we should do is to demonstrate that it is not tubercular; knowing the frequency of tuberculosis and tubercular rheumatism, we should think pathogenetically rather than pathologically."

Prognosis.—The prognosis of tubercular rheumatism has to be considered from two points of view, from the rheumatic and from the tuberculosis which accompanies or produces it.

The prognosis is variable with regard to the rheumatism. Generally speaking tubercular rheumatism occurs in the milder forms of tuberculosis.

Treatment.—The great value of the diagnosis is the key it gives to the correct treatment. Instead of placing the patient on a restricted diet and dosing him with useless diges-

tion destroying salicylates, we can plan the treatment on broad hygienic lines.

The general treatment is that of tuberculosis: fresh air, sunlight, forced feeding, cod-liver oil, tonics, etc.

The object of the local treatment is to protect the acute joints and prevent the development of a true tubercular arthritis; all active forms should be regarded as pre-tubercular lesions. In the chronic forms ankylosis and deformity are to be guarded against; if already present, they should be treated according to general surgical principles, due weight being given to their tubercular nature. In the acute attacks Poncet speaks highly of the use of cryogenine; it has the same effect in tubercular rheumatism that the salicylates have in true rheumatism.

In conclusion I will say that my original intention was to present to this Society the results of a clinical study on tubercular rheumatism, but in the course of the work I soon realized that it would be better to present Poncet's personal views and statements with the object of bringing out a frank and free discussion. A knowledge of Poncet's conception is of great value in diagnosis, and when we are face to face with so-called rheumatism we would do well to make an earnest endeavor to test its worth.

A complete bibliography up to July, 1903, will be found in Poncet and Leriche's monograph, *Le Rhumatisme Tuberculeux*, *L'Oeuvre Medico-Chirurgicale*, Critzman, No. 34, Masson et Cie., Paris, August, 1903. From August, 1903, until March, 1909, the literature will be found in Poncet and Leriche's book, *Le Rhumatisme Tuberculeux*, Octave Doin et Fils, Paris, 1909. Poncet and Leriche are shortly to publish a volume entitled *La tuberculose inflammatoire*.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held February 14, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

MEMBRANOUS PERICOLITIS.

DR. PARKER SYMS presented a girl, 17 years old, who was admitted to the Lebanon Hospital on December 24, 1911. She was born in Roumania and gave a negative family history. Her menstruation began when she was 12 years old, and had been regular and uncomplicated. Until one year ago the patient had been in good health, except for the fact that she had suffered from chronic constipation, having to depend on cathartics. A year prior to her admission to the hospital she had a sudden attack of cramp-like pain which localized itself in the right iliac region, and which persisted between one and two weeks. Since then she had had four similar attacks, each accompanied by vomiting. The last one, which occurred a month ago, was the most severe.

The case was regarded as one of appendicitis, and the patient was operated upon on December 27, 1911. Through a small, gridiron incision the appendix was delivered and removed. On account of the insignificance of the appendicular lesion, as compared with the severity of her attacks, and on account of her chronic constipation, a further inspection was made. There was no "Lane kink," but the ascending colon, from the cæcum up, was enveloped in a typical Jackson's membrane. This extended from the parietal attachment of the peritoneum across the colon, covering about two-thirds of its circumference. The colon was apparently movable within this membrane, which appeared to be

separated from the colon by a space or by œdema. The membrane was incised along the border of the flank and then removed from the colon, to which it was found to be lightly attached. The separation left a slightly bleeding surface, but it released the colon, leaving it free and movable.

The patient made an uneventful recovery from the operation, and since then has been constantly gaining in health. At present her bowel function is nearly normal, and it would seem as though she has been cured of this cause of chronic constipation.

DIVISION OF THE ULNAR NERVE: SECONDARY NEURORRHAPHY.

DR. SYMS presented a man, 35 years old, who was admitted to the Lebanon Hospital on December 27, 1911, with the history that five months prior to his admission he had been cut just above the right elbow by a piece of glass. The wound had been sutured by a physician, and had promptly healed. From the time of the injury, however, there had been a loss of those functions supplied by the ulnar nerve: there was slight atrophy of the interossei groups and of the adductor muscles of the thumb, together with trophic changes in the skin of the little finger and the ulnar side of the ring finger. There was also loss of touch and pain sensations extending from the fingertips to the wrist-joint. In other words, there was evidence of complete severance of the ulnar nerve. At the site of the wound the usual bulbous swelling could be felt. This was the neuroma which is always found at the proximal end of a divided nerve.

Operation, January 3, 1912: The nerve was exposed above the condyle. There was quite a large bulb at the end of the upper segment, and the two segments were connected by a fibrous cord. Nerve suture was accomplished by Brun's method, that is to say, the fibrous cord was split longitudinally, and the incision carried up and down into the neuroma of each segment of the nerve. Then the halves of the fibrous cord were stretched laterally, and interrupted sutures were applied in pairs until the nerve-trunks were brought in apposition. This point of juncture was closed by folding the redundant portions of the fibrous cord over it and suturing them together.

The patient made a satisfactory recovery, the wound healing by first intention. There was already, apparently, a slight im-

provement, although it was too early for restoration to have taken place. Dr. Syms said he hoped to show the patient again at a later period, when the final result might be known.

STONE IN THE COMMON DUCT: BILIARY FISTULA.

Dr. Syms presented a woman, 37 years old, who was admitted to the Lebanon Hospital on November 6, 1911. Her family history was negative, and her past history, with the exception of an attack of malaria nine years ago, was unimportant.

Eight months ago the patient was operated on by Dr. Syms for severe gangrenous cholecystitis. The gangrenous gall-bladder, which contained a large number of stones, was removed, and three large stones were removed from the common duct, which was then drained by a tube leading to the surface. At the time of this operation the patient was in a desperate condition, and complete exploration of the duct was evidently not accomplished, for undoubtedly a stone was left at its duodenal end. The patient made a satisfactory operative recovery, and left the hospital in restored health, but with a fistula persisting at the site of the drainage tube.

When the patient was readmitted in November there was a biliary fistula discharging greenish bile; her stools were clay colored, and it was assumed that there must be some obstruction to the common duct. The final operation was done November 22, 1911. The abdomen was opened to the inner side of the sinus, and the latter was dissected from the abdominal wall. This sinus consisted of a fibrous tube which could be clearly demonstrated, and which was entirely separated from the abdominal contents by blunt dissection. It formed a T-shaped communication with the common duct about its middle. A large stone was found in the common duct near the duodenum, which was removed by opening the duct. After this the duct was found to be clear in each direction, and the new opening into the duct was closed. The old sinus was resected, but was left attached to the peritoneum. Immediately after the operation the patient began to show bile in her stools. Her wound closed satisfactorily, and she made a complete recovery.

Dr. Syms said he reported this case on account of the complete new duct which had formed around the rubber drainage

tube, which was used at the time of the first operation. This new duct consisted of a fibrous tube of such definite structure that it could have been utilized to make an anastomosis with the intestine, should such a procedure have been necessary.

A NEW METHOD FOR OPERATING UPON VOLUMINOUS CÆCA OR CÆCUM MOBILE.

DR. JOSEPH A. BLAKE presented a patient illustrating this method. The condition for which this patient was operated upon presents a well-defined symptom complex in which the major symptom is pain in the right lower quadrant occurring in ill-defined attacks and always associated with gas. There is also as a rule constipation, and in many cases general evidences of intestinal auto-intoxication. There may be a more or less well-developed colitis. Upon examination of one of these patients one finds evidences of distention of the cæcum marked by tympany and splashing, and usually the balloon-like cæcum may be felt or even seen. Radiography with the aid of bismuth shows the cæcum to be large both in diameter and in length, to often hang into or lie in the true pelvis; and that it fails to empty itself in the normal period.

Upon operation the cæcum is found to have a more or less free mesentery and to be more than usually movable. Hence the term cæcum mobile, which is usually used to describe the condition. The chief characteristic, however, is not its mobility, but rather its size, therefore the term voluminous cæcum is suggested as a better one. And it will be found that the symptoms are better explained on the hypothesis of an atonic dilatation as the cause rather than mechanical obstructions due to kinks arising from its mobility.

What the cause of the condition is, is not altogether clear, but it is frequently associated with general enteroptosis, and undoubtedly developmental errors are the chief factors in its production.

The failure of the large intestine to conform to environment and the secondary changes produced by habit, namely, atony, distention, and catarrh, are jumbled in an etiological mess.

The operation performed upon this patient is based upon the theory that the symptoms are caused and the condition perpetuated by the enlargement of the cæcum, leading to stasis and

fermentation and the production of gas, which in turn, by over-distention, increases the atony and the inability of the cæcum to empty itself. Conversely, unless these mechanical conditions are well defined, the operation is not indicated.

The operation consists, after removing the appendix and inverting its stump, in inverting or plicating the wall of the cæcum by a continuous Cushing suture of linen or silk, commencing at the site of the appendix and uniting the ventral and lateral tæniæ or striæ musculares together aborally along the ascending colon for a sufficient distance, usually four to five inches, to produce the desired effect. As the continuous suture is introduced and drawn tight, the length and therefore the pendulousness of the cæcum is diminished as well as its calibre. The striæ musculares afford firm tissue to support the suture, and it will be found to be a safe and secure procedure.

The post-operative convalescence of this patient and the others so far operated upon, some seven or eight in number, has been perfectly smooth and there has been an exceptional freedom from gas pains.

The radiographs taken after the operation show that very little bismuth enters the cæcum, and that it remains in a normal position.

How long the suture will effect this result has to be ascertained. The removal of the portion of the cæcum inverted has been considered, but this would add considerable risk and might jeopardize the contractility of the cæcum that is so important to preserve.

Among the rather extensive literature upon cæcum mobile only one reference has been found in regard to plication, namely, Klemm, *Archiv. für klin. Chir.*, July, 1911, p. 558, and he does not state the method he employs.

The clinical data of the patient presented were briefly as follows:

R. J. S., married woman, 29 years of age. Admitted to Presbyterian Hospital, November 29, 1911, suffering from pain in lower left abdomen and attacks of indigestion accompanied by gas. She has had two children, one miscarriage, and was said to have had "falling of the womb." Upon examination the abdomen was found moderately lax, with tenderness in the lower left quadrant. Per vaginam, the cervix was soft, with a

slight laceration of the left side. The uterus was tipped sharply backward into the hollow of the sacrum. It was movable, but motion caused pain. She was operated upon on December 4, 1911. The abdomen was opened in the median line with intention of doing a ventral suspension and correcting conditions that might be found in the left ovary. The uterus was found sharply retroverted and a cystic condition of the left ovary, which was partly removed. The appendix was found to be long and slightly swollen. There was a constriction about 2.5 cm. from its base. The cæcum was low down in the pelvis, freely movable, and very large. The appendix was removed, its stump inverted, and the cæcal wall plicated in the manner already described. The uterus was suspended by Gilliam's method. The post-operative convalescence was smooth, with a moderate amount of gas pains. X-rays with bismuth two weeks after operation showed the cæcum to be in good position and only containing a small amount of bismuth. The patient's condition since leaving the hospital has been much improved. Some of the improvement in her case must be laid to the correction of the uterine condition and removal of the cystic ovary, and it is problematical how much can be attributed to the plication of the cæcum: yet the patient states that her digestion is better and she has more freedom from gas than she has experienced for a long time. Her constipation has been entirely relieved.

DR. CLARENCE A. McWILLIAMS said he had done this operation in about five cases. It was easily performed, without any danger to the patient, and he considered it well worthy of imitation, as it certainly produced a marked diminution in the lumen of the cæcum, reducing the dimensions of the gut in both its transverse and vertical diameters.

DR. HENRY H. M. LYLE said that after careful observation and measurement of these cases of voluminous cæca during the past year, he had found that the condition varied widely, and as in some instances it gave rise to no symptoms whatsoever, it was at times difficult to determine what to do. As Clark of Philadelphia had put it, we must be led to operate, not by the size of the gut, but by the symptoms that the condition gave rise to. Another point in connection with these cases was that the patients required careful supervision after operation in regard to their food, abdominal exercise, hygiene, etc.

The proper selection of these cases for operation, Dr. Lyle said, as well as the best method of operation, was still unsettled. Some men were in favor of plication, rendering the cæcum less movable, while on the contrary one surgeon had advocated a method to make it more movable. There was considerable latitude to the movements of the cæcum within physiological limits, especially in women who had been pregnant.

DR. BLAKE said he did not mean to imply that by the method he had described we had reached the ultimate solution of this problem, but he did not believe that the mobility of the cæcum had anything to do with the symptoms. These depended on the amount of dilatation of the gut and its consequent atonicity. The operation was simply an attempt to prevent the cæcum from becoming over-dilated and the vicious chain of symptoms that followed such a condition.

DR. A. V. MOSCHCOWITZ asked what the relationship was, if any, between the so-called cæcum mobile, typhlotomy, and the condition described by Dr. Syms under the name of Jackson's membrane? In the latter condition, the cæcum was bound down, and the membrane was loosened, while in the condition described by Dr. Blake the cæcum was too mobile, and was fastened. In the one class of cases the symptoms were attributed to the fact that the cæcum was bound down, while in the other they were attributed to the fact that it was too mobile, and yet the symptoms complained of by these patients were practically the same. This whole problem, the speaker said, was an exceedingly intricate one, and the more he had tried to get it clear in his mind from the literature, the more confused did the clinical picture and pathology of these cases become.

DR. CHARLES H. PECK said he thought Dr. Blake had already answered Dr. Moschcowitz in his statement that it was not the mobility of the cæcum as much as its size and atonicity that he had aimed to remedy by this operation. In these cases this enormously dilated cæcum was present, which formed a reservoir for the fæces and which was unable to empty itself, and this condition, he thought, could be much improved by plication of the gut. He considered the operation described by Dr. Blake as an important step in the right direction in dealing with these cases.

DR. BLAKE, in closing, in reply to a question said the mesocolon of the cæcum was not interfered with in the slightest

degree. The true cæcum—that part beyond the ilcocæcal valve—was shortened. The speaker said that the term cæcum mobile was a misnomer, inasmuch as the condition was one of the ileocolic junction and the ascending colon in addition to the cæcum.

As to the presence of the so-called Jackson's membrane, Dr. Blake said that it was present always and was, in fact, a normal structure.

In answer to a question as to how the operation he had described relieved this condition of cæcum mobile, the speaker said that while it did not increase the muscular tonicity of the gut, it prevented the accumulation of fæces and thus relieved the stasis in this part of the colon.

HYPOPITUITARISM OF THE FROHLICH TYPE.

DR. F. KAMMERER presented a boy, 22 years old, who had been ill for the past eight years. This illness began with headaches and a slowly increasing impairment of vision, which had gradually in spite of treatment developed into absolute blindness in one eye and temporal hemianopsia in the other, with the bare possibility of recognizing fingers on the nasal side. The patient was only four feet and five inches tall. There was no unusual development of the bones of the head or extremities. Adiposity and pallor were well marked. No hair had developed on the pubes or chest, or in the axillæ. The external genitals were very small. There was no polyuria.

The X-ray pictures showed a marked enlargement of the sella turcica, with complete obliteration of the dorsum. Dr. Kammerer said this case was one of marked infantilism, with tumor of the hypophysis—the rather rare type—and he expected to report it more extensively later on.

CLEFT PALATE: LANE'S OPERATION.

DR. FRANK S. MATHEWS presented a child, five years of age, on whom he had operated for a wide cleft of the hard and soft palates two months ago. The cleft did not include the alveolar border. The case was shown because of the unusually good result, especially in the soft palate, there even being a well-formed uvula.

In operating on this case, Dr. Mathews said, the Lane method had been employed. The hinge flap had included the whole of

the mucoperiosteal covering of the hard palate, and had extended laterally over the alveolar border to the juncture of the jaw and cheek. On the "pocket flap" side, the undermining of the soft palate, after making the incision well laterally on its upper surface, permitted this flap to spread out well across the gap. By getting such wide flaps, the sutures could be inserted without tension, and there was wide overlapping.

The child's parents thought that the speech had improved somewhat since the operation.

DR. CHARLES N. DOWD thought the case presented by Dr. Mathews was a remarkable example of uranoplasty. At the present time the child's mouth could be inspected without distinguishing that there had been a cleft palate, as the uvula and soft palate were in such perfect condition. This might well be made a test case, and might furnish a good deal of information to the members of the Surgical Society.

The mother was intelligent and willing to aid the child in learning to speak properly, and he hoped the patient would be shown before the Society after a lapse of two years. There was a good deal of uncertainty about the ultimate result in cases that were treated by the Lane operation. A recent article by Berry in the *British Medical Journal* called particular attention to the poor power of speech which followed these operations. We did not yet know whether children learned to speak as well after this operation as after the Langenbeck operation. Berry was confident that they did not. Incidentally we must bear in mind that the mortality rate for doing this operation on very young children was larger than had frequently been supposed. Berry indicated that this was really somewhere from 12 per cent. to 40 per cent. if we watched the child for a few months after operation.

DR. WILLIAM A. DOWNES said he thought the Lane operation for complete cleft palate and harelip should not be done at one sitting. The harelip should first be repaired, immediately after birth, and then, after three or four months, when the nutrition of the child had improved, the Lane operation could be completed. The lip does not in any way interfere with the palate operation and has the great advantage of the completed alveolar arch.

Dr. Downes said he had done this operation in 15 or 20 cases. In several of these two years or more had elapsed, but he was

still uncertain as to their ultimate outcome as regarded articulation. While the appearance of the soft palate was very satisfactory at the outset, it often became shrunken in the course of time, even to the extent in some cases of allowing regurgitation.

DR. CHAS. L. GIBSON said that one small but important point in the technic of this operation was the use of the Reverdin needle for passing the sutures—a small-sized needle, with a very full curve.

DR. MATHEWS, in closing, said the child he had shown was now being taught to enunciate the letters of the alphabet, and he hoped that under proper supervision the articulation would improve.

In Lane's article on this operation, Dr. Mathews said, no mention was made of the mortality, which he thought must be very high. One of the most important factors in connection with the operation was the element of time: in this case, the operation lasted one hour, which should be about the average time. He recalled one case where the operator took fully three hours.

RETENTION OF URINE DUE TO ADHERENT APPENDICAL STUMP.

DR. MATHEWS presented a man of 50, who first came under observation at St. Francis Hospital 18 months ago. He was then suffering from complete retention of urine and cystitis, soon followed by a rise of temperature and hypogastric pain. Repeated examinations showed no cause for the retention either of nervous or mechanical origin. For some time he was treated by irrigation and perineal drainage. This resulted in some improvement, and he was able to void urine voluntarily, but with from 15 to 20 ounces residual, and he left the hospital in this condition.

In the spring of 1911 he suffered from an acute appendicitis, for which he was operated on, and during this operation, Dr. Mathews subsequently learned, many adhesions were encountered about the appendix, with little or no pus, and a hemorrhage occurred which was so profuse that the wound was hurriedly packed and the operation abandoned.

Last August the patient was again admitted to St. Francis Hospital, in the service of Dr. John Rogers, and was operated upon by Dr. Mathews. At this time there was a small sinus, which had remained since the date of the previous operation on

the appendix. The patient complained at times of severe hypogastric pain, and had almost complete retention of urine. The sinus was found to pass down between two coils of small intestine, and proved to be the termination of the appendix, the tip of which had been drawn through a hole in the mesentery of the small intestine. This probably explained the hemorrhage that had been encountered at the former operation: the operator had torn the mesentery in approaching the appendix, and had drawn the appendix through the perforation. There was also a band about the size of a lead-pencil running from the distal part of the appendix across to the vault of the bladder, which was doubtless the cause of the inability of the bladder to contract. This band had a lumen and seemed lined with granulation tissue. It was removed, together with the appendix, and an over-lapping operation done on the abdominal wall.

At the present time, six months after the operation, the bladder was still of large capacity, with five or six ounces of residual urine. However, the man's cystitis as well as his general health were much improved and he complained of no symptoms.

ARTHRITIS DEFORMANS OF THE HIP: ALBEE'S OPERATION.

DR. HENRY H. M. LYLE presented a man, 59 years old, who had suffered from arthritis deformans of the right hip for seven years, and whose condition had steadily grown worse. He was admitted to the medical side of St. Luke's Hospital, and after various therapeutic and orthopædic methods had failed to give him relief, he was transferred to the surgical side for operation. At this time he was helpless and bed-ridden.

Examination showed an increase in the bony elements about the hip, with marked atrophy of the corresponding thigh and calf muscles. The right leg was flexed, adducted, and rotated inward, abduction and extension being practically impossible. There was moderate tenderness over the hip, and distinct crepitus could be elicited. There was a practical shortening of an inch and a half. The skiagraph showed a typical arthritis deformans. The Wassermann and tuberculin reactions were negative.

On September 26, 1911, Dr. Lyle did an arthrodesis of the right hip according to the Albee method.

After a preliminary tenotomy of the adductors the hip-joint was exposed by a five inch incision, beginning just below the

anterior superior spine and running downward and inward parallel to the inner border of the sartorius. After retracting the sartorius outward, the intermuscular space between the tensor fasciæ femoris and rectus was separated by blunt dissection, thus uncovering the femoral neck. The surrounding ring of osteophytes was removed and the overhanging portion of the acetabulum was chiselled away, thus converting it into a flat bony roof. With the head *in situ*, a corresponding portion was removed from the upper surface of the head. The leg was rotated outward and as much of the cartilage as possible was removed from the surface of the head and acetabulum, the flat bony surfaces were brought in contact by abduction, and the wound closed without drainage. Both legs were enclosed in a double plaster spica extending from the thorax to the toes on one side, and to the knee on the other; just above the knees an iron cross-bar was inserted.

The patient although recently operated on has a firm painless ankylosis. Dr. Lyle presented him as an example of the value of Albee's operation. After an experience of four years with this operation, Dr. Lyle considers it to be a marked advance in the treatment of the mono-articular type of osteo-arthritis and as such it deserves a more extensive trial than it has received.

DR. FRED H. ALBEE said that in these cases the outward rotation was the most difficult element to overcome, together with the prevention of the recurrence of adduction. Of course, there is always a deformity of long standing to deal with, namely, adduction and flexion. Even the application of plaster-of-Paris was insufficient to overcome the adduction, and in order to strengthen the plaster the speaker said he had resorted to the use of U-shaped bands of metal extending from the pelvis to the knees, which were put in under the final layers of the plaster and allowed to remain until the plaster hardened, both thighs in this instance being included in the plaster cast, in abduction.

Speaking of the operation itself, Dr. Albee said he had done it 28 times. Twenty-three of these were in cases of osteo-arthritis and five in tuberculosis of the hip, and he was as well pleased with the results in the latter as in the former. The osteophytes or overgrowth of bone that came down over the neck of the femur must not be overlooked, and he could recall several cases where the operator had cut off too much of the head of

the bone, having been misled by the appearance of the osteophytes. They should be removed first, and then a part of the rim of the acetabulum, thus laying bare the head, of which about one-fifth should be removed. All the cartilage should then be removed from the remaining four-fifths of the head, which could be done by strongly rotating the femur outward.

Dr. Albee said that the function of a stiff hip-joint in good position was often surprisingly satisfactory—more so than a stiff knee, because in the hip we had the spine to compensate for the loss of motion. That motion took place only two inches above the normal hip. The speaker said that the more advanced the cases of osteo-arthritis, the quicker the ankylosis.

LE RHUMATISME TUBERCULEUX (PONCET).

DR. HENRY H. M. LYLE read a paper with the above title, for which see page 750.

DR. WALTON MARTIN, referring to the theory of Poncet that the tubercle bacilli produced at times simple exudative inflammation in joints, said that Dr. Prudden, in his work on pathology, called attention to the fact that the tubercle bacilli produce not only the characteristic tuberculous inflammations but also simple exudative inflammation.

Discussing the terminology of this affection, Dr. Martin said that if we agreed that the joint lesions are due to tubercle bacilli, then it would be a misnomer to call the disease rheumatism: the condition would then be one of tuberculosis, and not rheumatism. The speaker said he was much interested in this theory of Poncet, and he felt that more careful investigation along this line would lead to very interesting results.

DR. LYLE, in closing, speaking of the terminology of this condition, said the same objections were made in connection with gonorrhœal rheumatism, gout, etc. Poncet's theory was now practically accepted in France and other parts of Europe, and while the name *le rhumatisme tuberculeux* was rather unfortunate, as Dr. Martin said, still it was the name Poncet had adopted, and by that term the morbus Poncet was generally understood.

In many of these cases, Dr. Lyle said, the affection was regarded as a pre-tuberculous condition by Poncet and others, and this gave it added significance. Poncet's investigations along these lines had been very thorough and extensive, and for that reason he deserved great credit.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.


Stated Meeting, held February 5, 1912.

The President DR. GWILYM G. DAVIS, in the Chair.

ARTHROTOMY FOR ELBOW LUXATION.

DR. EDWARD B. HODGE exhibited a patient to show the result one year after arthrotomy for postero-external luxation of the elbow.

Male, 49 years of age, switchman, had his right arm amputated at the wrist following a crush 14 years ago. Six weeks before his admission to the Presbyterian Hospital, March 8, 1911, he fell from a freight car upon his left arm, injuring the elbow. There was swelling and disability. As the swelling lessened, he became able to use the arm, except bending the elbow. When admitted to hospital, the left elbow showed nearly full extension, flexion limited to 160 degrees. The olecranon was out of line with the condyles and to the outer side as well as posterior. The head of the radius rotated behind and below the external condyle. The X-ray confirmed the clinical diagnosis of postero-external luxation. It also showed several loose pieces of bone, chiefly in the region of the external condyle.

On March 10, under ether, several attempts at reduction failed. An external incision was then made, extending from above the external condyle down on the forearm. The muscles were separated from the region of the external condyle, and on retraction toward the median line a good exposure was obtained. The head of the radius, well posterior and behind the external condyle, showed a crack extending one inch down the shaft. A loose piece from the external condyle was removed.  Much difficulty the bones were replaced, using the handle

of an instrument as a lever. Muscles and ligaments were held in as nearly normal position as possible by chromic gut sutures. A cigarette drain was placed to the capsule, the skin closed with silkworm gut, and the arm dressed in acute flexion.

Convalescence was uneventful except for some numbness and tingling in the ulnar distribution. This is still present in slight degree. There was discharge of synovial fluid for 10 days, but no infection. Passive motion was begun early, and on discharge one month after operation the patient had at least 75 degrees of motion and could easily touch the back of his head with the palm of his hand.

The reporter emphasized the excellent exposure obtained by the external incision in dislocations of this type.

RESULTS IN THE TREATMENT OF FRACTURES OF THE FOREARM WITHOUT OPERATION.

DR. ASTLEY P. C. ASHHURST presented a paper in which were detailed the results obtained by treatment without operation in 52 cases of fracture of the forearm.

FRACTURE OF THE RADIUS ABOVE THE ATTACHMENT OF THE PRONATOR QUADRATUS MUSCLE.

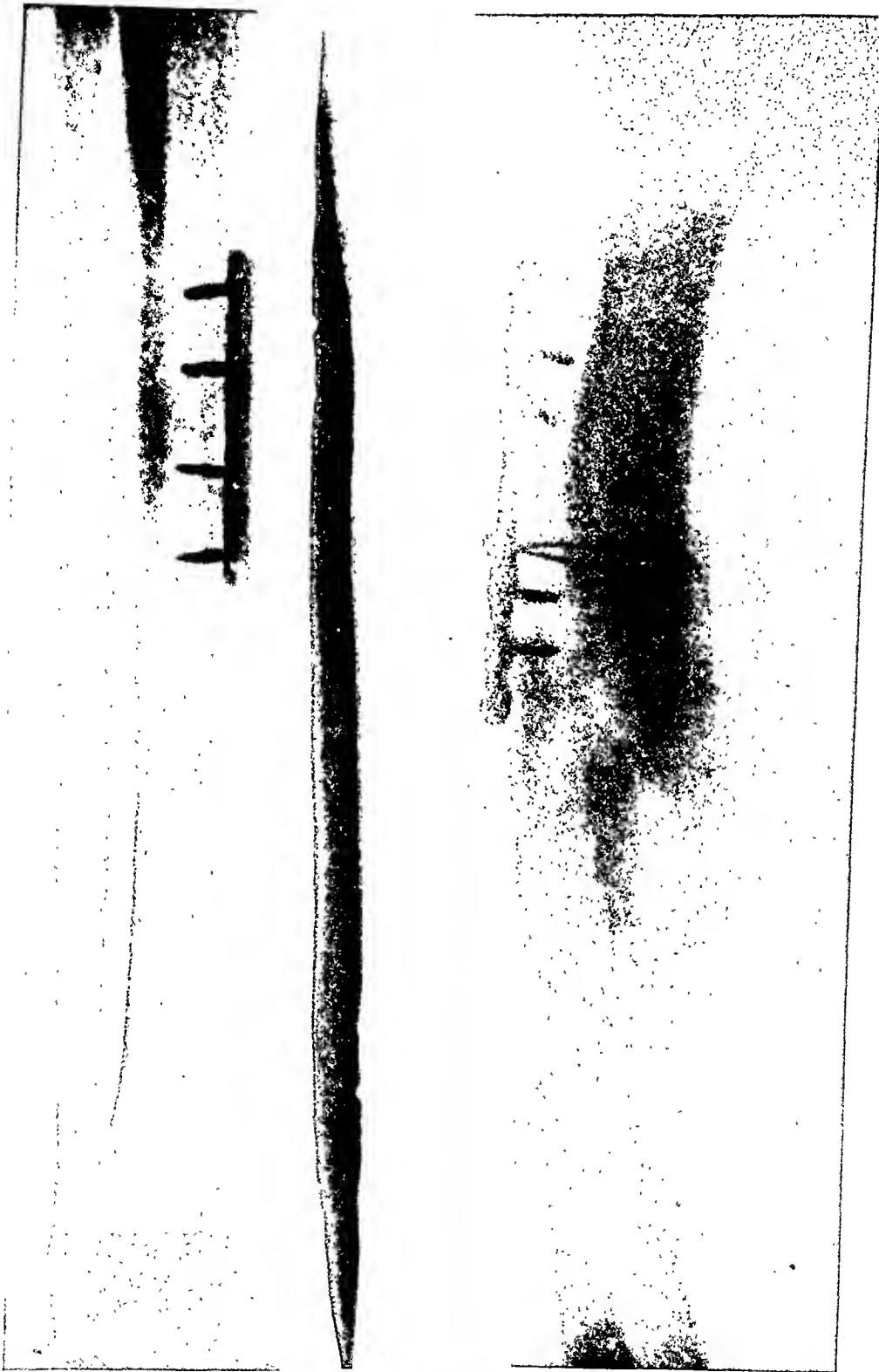
DR. EMORY G. ALEXANDER read a paper with the above title, for which see June ANNALS OF SURGERY.

OPEN OPERATION AND PLATING OF THE TIBIA AND FEMUR FOR RECENT FRACTURES IN A BOY OF TWELVE YEARS.

DR. JOHN H. JOPSON reported the following case:

J. H., aged 12 years, was admitted to the Presbyterian Hospital November 6, 1911, with a history of having been run over by an automobile. Examination showed a compound fracture of the middle third of the right tibia, simple fracture of the right fibula, and a simple fracture of the middle of the shaft of the left femur. There was lateral displacement of the fragments of the tibia, and an oblique fracture of the femur, with overlapping of the fragments, outward bowing, and $1\frac{1}{2}$ inches shortening. Three days later the right tibia was operated upon before some of the members of the American Congress of Clinical Surgeons, and a Lane plate used to fix the ends, after perfect approximation had been obtained by extension and manipulation.

FIG. 1.



Result after open operation and plating for compound fracture of tibia and fracture of femur in a boy of 12 years.

Superficial drainage was inserted and a plaster cast applied. Manual extension was used with the patient under ether, to overcome the shortening in the left femur, and lateral moulded splints applied in combination with Buck's extension. The operation wound healed without infection and with the fragments of the tibia in perfect position.

In spite of liberal weight extension to the left extremity, angulation and overlapping persisted in the fractured femur, with $1\frac{1}{2}$ inches shortening. Nineteen days after the injury the left thigh was operated upon, when there was a large amount of callus already present surrounding the ends of the bone, and considerable union. The fragments were separated and extension was applied, using Dr. Eldridge L. Eliason's apparatus, which is a modification of that originally suggested by Dr. Edward Martin. In Martin's method strong extension is used to effect reduction, the extension being made directly over the upper end of the lower fragment, using a sterilized canvas band as a retractor. With Dr. Eliason's assistance the shortening due to muscular contraction was overcome, although there was some difficulty in maintaining approximation of the fragments after removal of the retractor, but with patience, satisfactory reduction was effected and a Lane plate applied on the outer side of the bone. The callus was so thick that the screws in the upper part of the plate did not penetrate to the solid bone, and longer screws not being at hand, it was deemed wise to reinforce the plate by passing a stout silver wire around it and the bone. The wire was then twisted and cut off short. The wound was closed with superficial drainage and a plaster cast applied, which included the pelvis.

Severe shock attended the latter stage of the operation, and the patient's condition for a time was very alarming, although hemorrhage had not been free, nor had the operation been unduly prolonged. The boy also developed a severe attack of erythema multiforma during his convalescence.

Primary healing occurred, and ten weeks after the accident the casts were permanently removed and union was firm in both tibia and femur. While the X-ray shows a slight overlapping in the case of the latter bone, the shortening is almost imperceptible, being less than one-half inch, and the functional result is perfect.

OPEN OPERATION AND PLATING FOR OLD FRACTURE OF BOTH MALLEOLI.

DR. JOHN H. JOPSON reported also the history of a man, aged 28 years, who was admitted to the Presbyterian Hospital December 28, 1911. Six months before he had fallen a distance of 40 feet, catching his left foot between two uprights of an iron fence and fracturing his ankle. He was treated in a hospital in another city and wore a plaster cast for about two months. His ankle was greatly deformed, very painful, and he was unable to walk on it for any length of time, and was debarred from his occupation as a machinist.

An examination showed great inversion of the left foot, amounting to lateral dislocation, with displacement upward of the internal malleolus on the tibia, the external malleolus being turned inward at an acute angle. Flexion and extension were good, but lateral motion was abolished, and pain and disability pronounced (Fig. 2).

He was operated upon a few days later. An external incision over the fibula and external malleolus exposed the site of fracture, and the bone was divided at this point with an osteotome. A second incision was then made over the internal malleolus and inner surface of the tibia, the site of union between the two being exposed, and the malleolus was separated with an osteotome, following the line of union between the malleolus and shaft of the tibia. Attempts at reduction were made, but were resisted by the shortening of the tissues and upward displacement of the internal malleolus on the inner side of the ankle, and it was found necessary to remove a wedge of bone from the fibula at the site of the first osteotomy, after which the foot was forced outward into good position. A small Lane plate was applied over the point of division of the fibula to maintain correction, the upper edge of the internal malleolus having first been cut off where it was tilted widely from the shaft of the tibia. The limb was put up in a plaster cast. The wounds healed without infection. The cast was removed four weeks after operation, and union of the malleoli was then quite solid, the movements of flexion and extension were good, and a new cast was applied and the patient sent home (Fig. 3).

DR. ASTLEY P. C. ASHHURST said, in regard to the method

FIG. 2.



Fracture of both malleoli and internal dislocation of the ankle.

FIG. 3.



Result of open operation for fracture of both malleoli and internal dislocation of the ankle.

of securing extension in fractures of the femur for reduction of overlapping, he had used extension in the long axis of the leg by a compound pulley with a clove hitch above the knee in only three cases, and believes it is the best method, as one can get all the pull that the rope will stand. With the apparatus he employed a pull of 400 pounds was possible. This method well overcomes the shortening, making the limb longer by actual measurement than the normal, but makes the muscles so tense that one cannot feel the ends of the bones, and so cannot secure end-to-end apposition. In his first case, an ununited comminuted fracture which had been compound, and his second, a recent fracture, he operated, but even under ether and with the bone ends exposed he found extension by this method insufficient to reduce the fragments because the muscles were rendered so tense; but by putting an obstetrical hook over the ends of the fragments and angulating them until the ends met and then straightening them out again, reduction could be obtained without extension. In the third case he succeeded in getting perfect reduction by angulation over his forearm, without operation. They were all transverse fractures and therefore reduction, when once secured, was easier to maintain than is the case in oblique fractures.

DR. G. G. ROSS called attention to the statement Dr. Jopson made about the first case, that in any fracture of the femur in which the position was imperfect, and where he had to reinforce his Lane plate with a wire, he got prompt and satisfactory union, while in the tibia where he had perfect approximation he had delayed union. He had had this same thing happen many times to himself, where too perfect reduction with only a moderate degree of callus would be attended by delayed union.

DR. G. G. DAVIS remarked, as directly bearing on the point raised by Dr. Ross, namely the delayed union in fractures with too perfect reduction and too little callus formation, he had a recent fracture of the femur in which early operative reposition was made. Seven weeks later he cut down to remove the wire, and there was nothing to be seen on the outside of the femur but a sharply defined black line of fracture, not a bit of provisional callus, and union firm, showing that apparently provisional callus is not essential to perfect union.

HOUR-GLASS STOMACH WITH PYLORIC STENOSIS.

DR. JOHN H. JOPSON detailed the history of a woman, aged 35 years, who was referred to him by Dr. James E. Talley with a diagnosis of probable gastric ulcer and perigastric adhesions. She gave a history of gastric hemorrhages 15 years before and recurrent gastric symptoms 10 years later. Since that time she had suffered from repeated attacks of the same nature, and had been treated by routine medical measures; she was never entirely free from symptoms between attacks, suffering more or less constantly from pain, indigestion, and gaseous eructations and annoying hiccoughs. She was a semi-invalid, although pursuing by pressure of circumstances her occupation of stenographer.

The stomach contents after test meal showed an excess of hydrochloric acid, but no blood. Physical examination of the abdomen was practically negative, there being no gastric dilatation, no points of tenderness, no unusual muscular rigidity, and no tumor.

At the operation a typical hour-glass contraction of the stomach was found, which was produced by an old thickened ulcer about three-quarters of an inch in diameter, situated at the middle of the lesser curvature, and which had surrounded itself with numerous perigastric adhesions. These adhesions had resulted in a folding upon itself of the anterior stomach wall and an elevation of the same and of the greater curvature, with adhesion to the gastrohepatic omentum. The pyloric pouch was considerably larger than the cardiac pouch. An old smooth scar at the pylorus caused a marked stenosis at this point also. Gastrolisis was performed, careful dissection and division of the perigastric adhesions being sufficient to unfold the stomach until the lumen of the contracted portion was doubled and its patulousness insured. No plastic operation on the stomach wall appeared necessary, and posterior gastro-enterostomy to the pyloric pouch concluded the operation. The gastric symptoms were quickly relieved, and the patient has remained well, two years having now elapsed. She has gained in weight, digestion is good, and beyond an occasional hiccough, which is an explosive phenomenon to which she seems peculiarly liable, she exhibits no stomach symptoms.

FIG. 4.



Fulton's lateral angular splint.



DR. WILLIAM L. RODMAN called attention to the unreliability of skiagrams in cases of supposed hour-glass contraction of the stomach. He had known of four or five cases where the skiagram pointed to a well-marked condition of this kind, yet on exploration no approach at hour-glass stomach could be found. He did not know how to explain this, unless it be due to a temporary contraction of the gastric walls, but it is nevertheless a well-attested fact.

A LATERAL ANGULAR ELBOW SPLINT.

DR. Z. M. K. FULTON presented a new angular splint, saying that in the treatment of fractures of both bones of the forearm some form of angular splint, immobilizing the elbow, is advocated by many surgeons.

The chief objection to the internal angular splint is, that it gives a position of insufficient supination. Fractures, especially above the insertion of the pronator teres, are liable to be followed by incomplete supination when treated in this position. The anterior angular splint has the disadvantage of having to be applied to the rounded belly of the biceps muscle. If not carefully watched it is liable to "creep" downward and produce serious pressure upon the anterior surface of the forearm below the bend of the elbow. This position also is sometimes uncomfortable to the patient.

If a splint could be made to be attached to the inner surface of the arm and elbow, and at the same time retain the forearm in a position of sufficient supination, it would meet some or all of these objections.

The splint which he presented is very easily made by uniting the two parts with a piece of galvanized sheet iron or any other suitable metal, which can be shaped so as to give any degree of supination. A position of supination about midway between those commonly used is the ideal one. It brings the bones of the forearm in exactly the same plane, and each parallel to the surface of the splint. In this position also the greatest muscular relaxation is obtained (Fig. 4).

In actual use he had found this splint to be easily retained in position, very comfortable, and when combined with a short posterior splint, a very efficient dressing.

BOOK REVIEW.

MANUAL of CYSTOSCOPY. By J. BENTLEY SQUIER, M. D., Professor of Genito-Urinary Surgery, New York Post-Graduate Medical School and Hospital, and HENRY G. BUGBEE, M. D., Instructor in Genito-Urinary Surgery, New York Post-Graduate Medical School and Hospital. 117 pages with 26 plates. New York, Paul B. Hoeber, 1911.

This little manual is apparently designed as a primer of cystoscopy for students and is as brief and concise as such a book could well be. The history of the development of the cystoscope is first outlined, very briefly, after which the technic of the use of the instrument is taken up. A method of making a phantom out of a rubber ball for practice is described, the necessary preliminary procedures upon the patient and the instrument are detailed and the appearance of the normal bladder is given. Pictures of the pathological bladder follow and are briefly discussed, and a consideration of ureteral catheterization and cystoscopy in the female completes the book. There are a number of excellent color plates, but the book itself is little more than a syllabus and is hardly adequate to do more than direct the student's attention to the subject. Still its brevity may serve to emphasize the fact that a knowledge of cystoscopy is to be obtained by the examination of many bladders rather than of many books.

J. E. JENNINGS.

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LOCAL ANESTHETICS IN TRAUMATIC SURGERY.

Local anesthesia should be given the extensive use in traumatic surgery in this country that it enjoys in France and Germany, is the opinion of Simon J. Young, of the Chicago College of Surgery, writing in the *American Journal of Surgery*, February 1912.

He finds by personal experience that the field of usefulness of local anesthesia has been so highly developed in Germany, that it has reached large proportions. The value of this means of anesthesia is attested to by such men as Bloodgood, of the Johns Hopkins Hospital; Ochsner, of Chicago; George Vaughan, Gaston Torrance and many others.

Young is particularly favorable to the use of Novocain and Novocain-Suprarenin Synthetic. He remarks: "For injuries to fingers and toes necessitating an operation, he uses anesthesia by infiltration. The success of this method depends upon its thoroughness, and, by the use of Novocain, a quantity may safely be employed, sufficient to produce an absolute degree of anesthesia. This method is also suitable for the ligation or suture of arteries and veins, tendon and muscle suture and even amputations. For this purpose Young uses Novocain or Novocain-Suprarenin, as the occasion seems to warrant."

He remarks that the toxicity of Novocain is very slight, and he says that very often in Germany as much as 200 c.cs. of a 1 per cent. solution was used without danger for amputations other than that of fingers and toes. Young prefers the venous method of producing anesthesia, and he finds that this method of using Novocain is decidedly advantageous for such operations as amputations, resection, bone suture, tendon suture, extraction of foreign bodies, suture of blood vessels and nerves, and indeed for almost any operation of the same nature.

His article is decidedly helpful and well worth reading.

ALKALOIDAL THERAPEUTICS.

I have examined quite carefully the copy of "Alkaloidal Therapeutics," and am greatly pleased with it. It is certainly an excellent summary and occupies a place of its own. It is in my opinion a real addition to our therapeutic works, and I have been surprised at the amount of (to me) new matter it contains.—J. B. McGEE, *Professor Therapeutics and Materia Medica, Cleveland College of Physicians and Surgeons, Cleveland, Ohio.*

A NEW THYROID PREPARATION.

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Physicians who are desirous of learning more of this new thyroid preparation will do well to send a request to the manufacturers, Parke, Davis, and Co., at their home offices in Detroit or any of their branch houses, for their new booklet descriptive of the product. It bears the title "Thyroid Therapy" and contains a lot of useful information.

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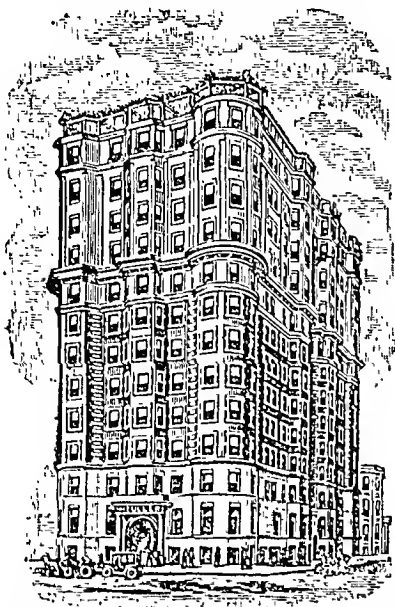
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Willy: "Monotony, ma'am."

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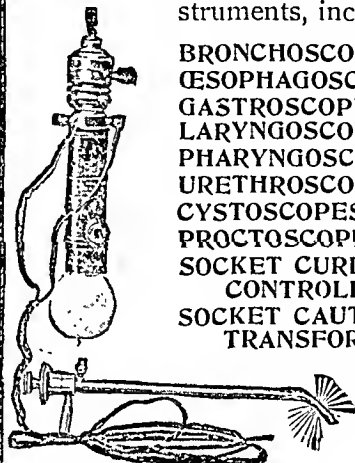
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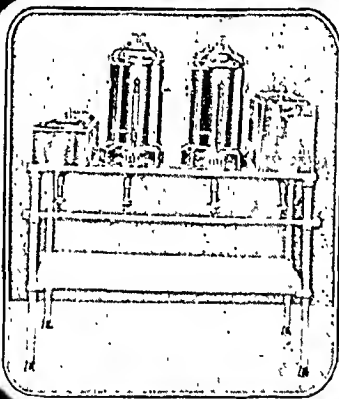


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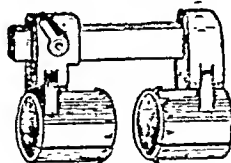
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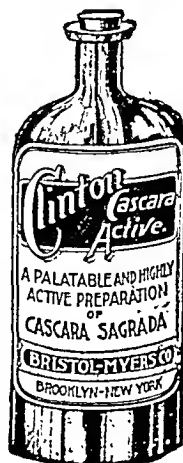
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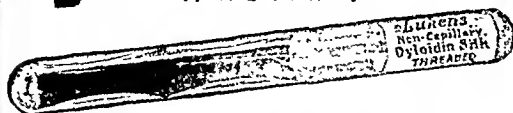
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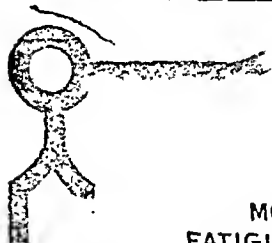
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ANNALS OF SURGERY

VOL. LV

JUNE, 1912

No. 6

ORIGINAL MEMOIRS.

GENERAL INFECTION FOLLOWING ACUTE TONSILLITIS.*

BY WILLIAM J. TAYLOR, M.D.,
OF PHILADELPHIA.

It has been my fortune to have seen during the past few years a number of instances of profound constitutional and localized infection following acute tonsillitis. These have covered wide areas in the body and have involved various tissues and organs.

The first was that of a gentleman of forty-six years of age, who had a violent tonsillitis, evidently streptococcic and distinctly not diphtheritic in character, which was followed by arthritis of both elbows. This was presumed to be rheumatic and resulted ultimately in complete ankylosis of both joints.

After various methods of treatment had been tried by his physicians in a neighboring city, including repeated etherization and attempts to secure motion in the joints (fourteen attempts in as many weeks), he was finally referred to me for surgical treatment.

An examination by the X-ray showed complete and firm ankylosis of each elbow and almost total destruction of the joints. The elbows were fixed at such an angle that he was helpless, he could not dress nor feed himself and, what annoyed him almost more than anything else, he could not even use his handkerchief.

I resected his left elbow, removing the disorganized joint and being careful to take away an ample amount from the humerus as well as from the ulna.

* Read before the Philadelphia Academy of Surgery, March 4, 1912.

The result from a practical stand-point has been most satisfactory in that he has perfect freedom of motion and a thoroughly serviceable arm.

I declined to resect both elbows at that time, preferring to try what could be accomplished with the left one, leaving to a subsequent occasion operation upon the right.

He has been so much improved in every way and can carry on his business as draughtsman, that nothing further has been attempted.

The second case was that of a small child five years of age, who had an acute tonsillitis, presumably streptococcic, for there was no diphtheria, followed shortly by an epiphysitis of the left femur, and for months she was ill. Finally recovery took place, but with a permanently damaged hip-joint.

The third was that of a lady of twenty-nine years, the mother of three children, who was apparently in perfect health with the exception of a uvula which was somewhat long and annoying. The end of the uvula was clipped off in the office of a throat specialist and by the next day she had an acute tonsillitis followed by very high temperature and evidence of profound constitutional infection. At the end of 48 hours she complained of abdominal pain (she was menstruating at the time) over both ovaries, and this progressed until her symptoms were so urgent that the abdomen was opened by another surgeon. An abscess of the right ovary and tube was discovered with general septic peritonitis.

Death followed in less than a week from the onset of her symptoms and was clearly due to a streptococcic infection with the primary seat of invasion in the tonsil and uvula.

The fourth case was that of a lady of forty, who had an acute tonsillitis directly traceable to an infected telephone through which she had been speaking. Her butler had tonsillitis and used the telephone, then a member of the family developed tonsillitis shortly after speaking through this same telephone, and soon my patient was attacked. All of them were probably streptococcic in origin.

She was a frail and delicate woman and before her throat was entirely well she went to the opera, from which she returned with a chill and very violent headache, and marked increase in her throat discomfort.

A hypodermic injection of morphia was given to her in her left leg by her physician, who used every possible precaution

against contamination by the needle. Soon there was another chill followed by fever and a violent cellular inflammation of the whole of the left leg.

When I saw her some days later, she was in a desperate condition. I opened the leg from the knee to the ankle and gave vent to much pus and broken-down fatty tissue. A smear from this pus showed pure streptococci, but a culture taken at the same time could not be depended upon through an unfortunate mishap in the laboratory.

I have never seen an instance of more profound sepsis; her blood was not red but of a chocolate color, and for a long time I feared she could not possibly live. She recovered only after weeks of illness.

I have seen several other instances of general sepsis following acute tonsillitis, but these four cases will amply illustrate the extreme danger which may result from the very common affection, and which I do not think has been fully appreciated by the general practitioner of medicine.

Enlargement of the cervical lymph-nodes following tonsillar infection is of course very common to all of us, and I have purposely not taken up that phase of the subject. Neither have I considered the infection of the mastoid cells and cerebral complications, of which we all see a few instances.

The masterly article by the late Dr. Frederick A. Packard, the Wesley Carpenter lecturer for 1899, "On Infection Through the Tonsil Especially Connected with Acute Articular Rheumatism," has drawn attention to the importance of this subject, and covered very thoroughly the literature up to that time.

Various observers have shown the relation between angina and rheumatism, and have shown that a large number of staphylococci and streptococci are present in the scrapings from the tongue and mouth, as well as many other forms of bacteria. As the tonsil belongs to the lymphadenoid tissue and is covered by plicated and involuted mucous membrane and is a collection of recesses and glands, it can readily be seen how general infection can follow an acute tonsillitis.

The question of absorption through the tonsils of various materials has been carefully studied, and their power of filter-

ing bacteria is found to be somewhat similar to the lymph-nodes, and to this extent they are of great benefit.

We all know that endocarditis is not an unusual result of tonsillitis.

Packard mentions a case (B. Auché, *Annales de la Polyclinique de Bordeaux*, 1892) of synovitis of the knee and ankle requiring operation, which was followed later by a pleural effusion, and also two cases of peritonitis occurring in the course of tonsillitis as recorded by Groedel and Froelich.

It has been proposed that in acute articular rheumatism (Vosanyi and Lenare, Sixteenth International Congress) the tonsils be immediately and completely removed, and in certain cases where this has been done, it has been followed by a prompt subsidence of joint symptoms and rapid convalescence of the patient.

This is such a radical procedure that it takes our breath away, and only in view of profound constitutional complications can it be considered.

The tonsils as points of entrance for tubercular infection have been well known for a long time. George B. Wood (*Jour. A. M. A.*, May 6, 1905, p. 1425) has demonstrated that in pigs the course of tuberculosis is through the pharyngeal and tonsillar structure, through the glands in the neck into the thorax, and finally to the lung itself. He proves that the tonsillar tissue is more resistive to the action of the tubercle bacilli than the adjacent lymph-glands.

David J. Davis (*Jour. A. M. A.*, July 2, 1910), in an experimental study of the bacteria isolated from the tonsils, found in nearly every instance a pure growth of *Streptococcus pyogenes* from the crypts, and an intravenous injection in rabbits was followed by acute arthritis in nearly every instance.

In a discussion at the last meeting of the American Surgical Association (*Transactions Amer. Surgical Assoc.*, vol. xxix, p. 148) Dr. Maurice H. Richardson mentions a series of cases of constitutional infection all preceded by a simple tonsillitis. Among these were three cases of fatal peritonitis, a phlegmon of the neck, a phlegmon of the fascia lata and all the muscles, a sepsis around the left hip, and total gangrene of the lower extremity.

A THORACIC ANEURISM TREATED WITH GOLD WIRE AND GALVANISM.*

WITH NOTES ON A PREVIOUS CASE AND ON EXPERIMENTAL STUDIES.

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THE writer first learned of the Moore-Corradi operation from Dr. Charles L. Gibson, resulting from which he practised wiring with electrolysis four times in a previous case of aneurism, one of the innominate artery (unpublished), and also, up to the present date, in the aortas of 151 dogs, the object of the experimental work being to glean knowledge from which principles could be defined that might put the operation on a more scientific footing than heretofore. The recovery experiments still lack completion. All of the operations on the dogs were performed under ether anæsthesia. In some preliminary experimental work on this subject as well as in the recovery animals of this series, the writer received valued assistance from Dr. Robert P. Wadham and Dr. Arthur M. Wright.

The patient here discussed was admitted to Bellevue Hospital in the service of Dr. A. A. Smith, to whom the writer is indebted for the case, and was operated upon in the service of Dr. Bryant, to whom the writer is indebted for the courtesies of his division.

The aneurism developed subsequent to the patient's having been hit on the right hip by the mud-guard of a rapidly moving taxicab and thrown onto the front of his chest and abdomen, 8 months previous to operation. His age was fifty-five; occupation, tailor.

Symptoms before Operation.—Constant pain, cough, shortness of breath on slight exertion. The pain is augmented by coughing

* Case presented before the New York Surgical Society, February 28, 1912. Experimental research through the courtesy of the New York University and Bellevue Hospital Medical College. Special indebtedness to Prof. R. M. Pearce and Prof. Douglas Symmers for facilities lavishly granted by them in the pathological department.

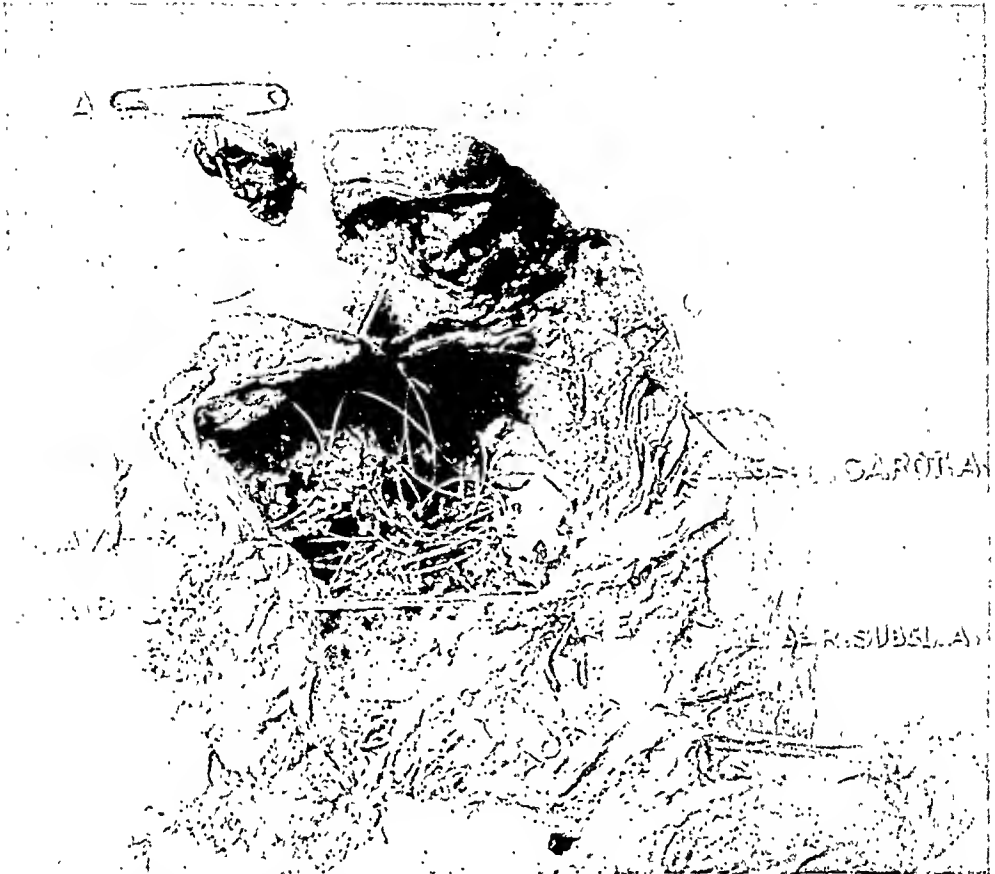
owing to a recent spontaneous fracture across the middle of the sternum.

Physical Examination.—Pulsating expansile tumor protruding a little above the surrounding skin level, at the right edge of the sternum, having eroded through the right second costal cartilage and adjoining portion of the sternum. Crepitus felt with expansile pulsation over middle of sternum. Bruit. A little thrill on exertion.

The plan of operation, based on the animal experimentation and the lessons learned from the previous case, was, to bring as much of the introduced wire as possible into contact with the wall of the sac, and then by means of the current both to injure the areas where the wire touched, and to produce a fibrinous clot along the wire, which at the sites of trauma would form an adhesion with the artery during the electrical séance (Fig. 5). In dogs such adherent fibrin undergoes subsequent organization, binding the wire to the sites of trauma, while that fibrin having no opportunity for adhesion, later breaks away, leaving the wire bare. This carpentering, as it were, into the aneurismal wall of linear areas of organized fibrin, should, like ribs, fortify the structure.

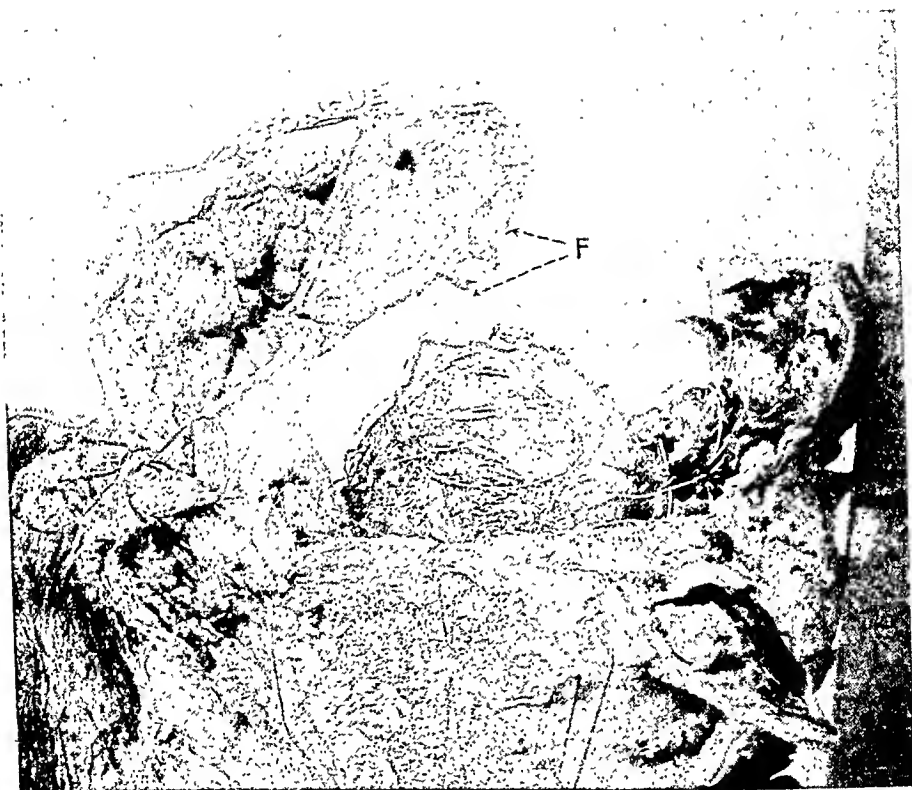
The deposit of the laminated fibrin in aneurisms as a result of the wiring and electrolysis operation is ostensibly a secondary event consequent upon a trauma to the intima, associated with a sluggish blood current, such as could be found in recesses of the aneurism or within a snarl of wire. In the specimen of the innominate aneurism that had been wired with electrolysis, in one situation—a recess overhanging the clavicle—where quite a number of loops of wire were grouped together in relation with the aneurismal wall, a mass of laminated fibrin had been deposited on the latter (Fig. 1, B), and projecting centrally therefrom into the cavity to a height of about two and a half inches was a further deposit of laminated fibrin supported in the meshes of a snarl of wire (Fig. 2). Also one isolated loop of wire (Fig. 1, C) in contact with the opposite wall was associated with a deposit of laminated fibrin about an eighth of an inch thick, which covered an area of about two inches in diameter.

FIG. 1.



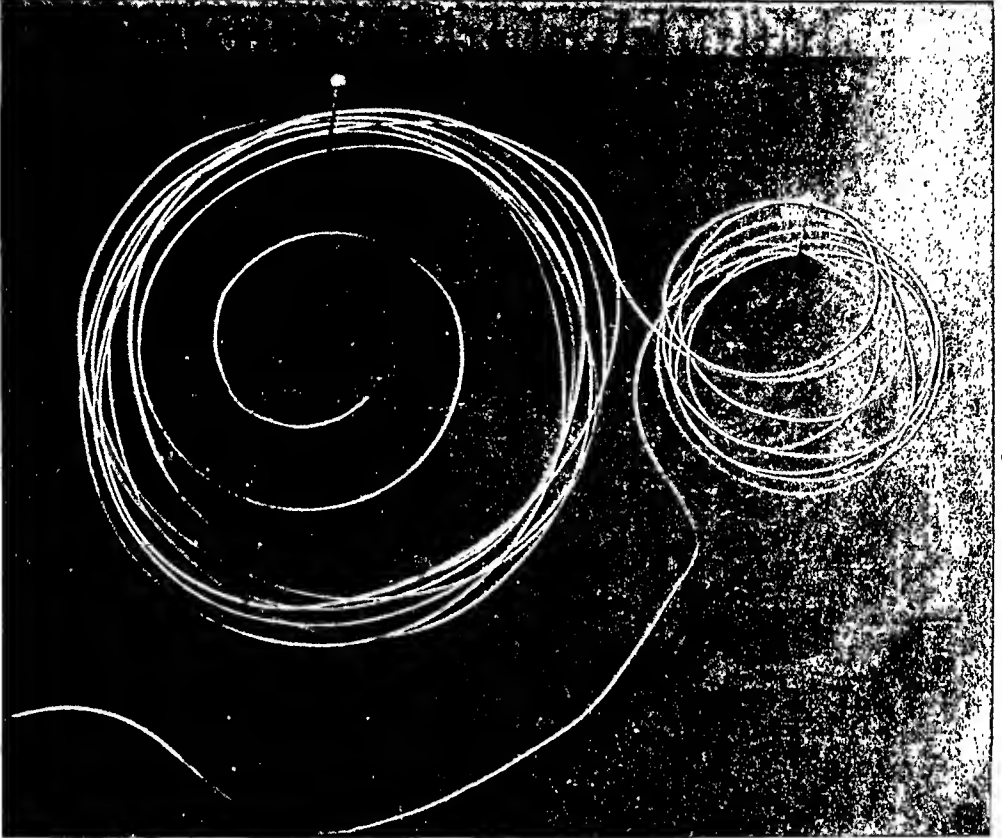
Specimen from the previous case, one of innominate aneurism, which had been wired our times. A portion of the wire (A) had been pulled out by unscientific hands. B, main mass of laminated fibrin which was attached by its base to the bottom of the recess overhanging the clavicle, whence it projected upward about $2\frac{1}{2}$ inches into the cavity of the aneurism supported in the meshes of a snarl of wire (cf. Fig. 2). C, isolated loop of wire imbedded in an area of laminated fibrin about 2 inches in diameter and about $\frac{1}{8}$ inch in thickness. D, site where three loops of wire are bound down to the intima by scar tissue. The projection here is caused by a bony prominence forming the posterior margin of a deep erosion of the clavicle. Many centrally located loops of wire presented themselves free from fibrin and untarnished. E, aneurismal opening. The probe lies in the right carotid artery, which passed across the front of the trachea. The right subclavian artery had the most distal origin of any of the vessels arising from the arch of the aorta, and passed around to the right side behind the trachea.

FIG. 2.



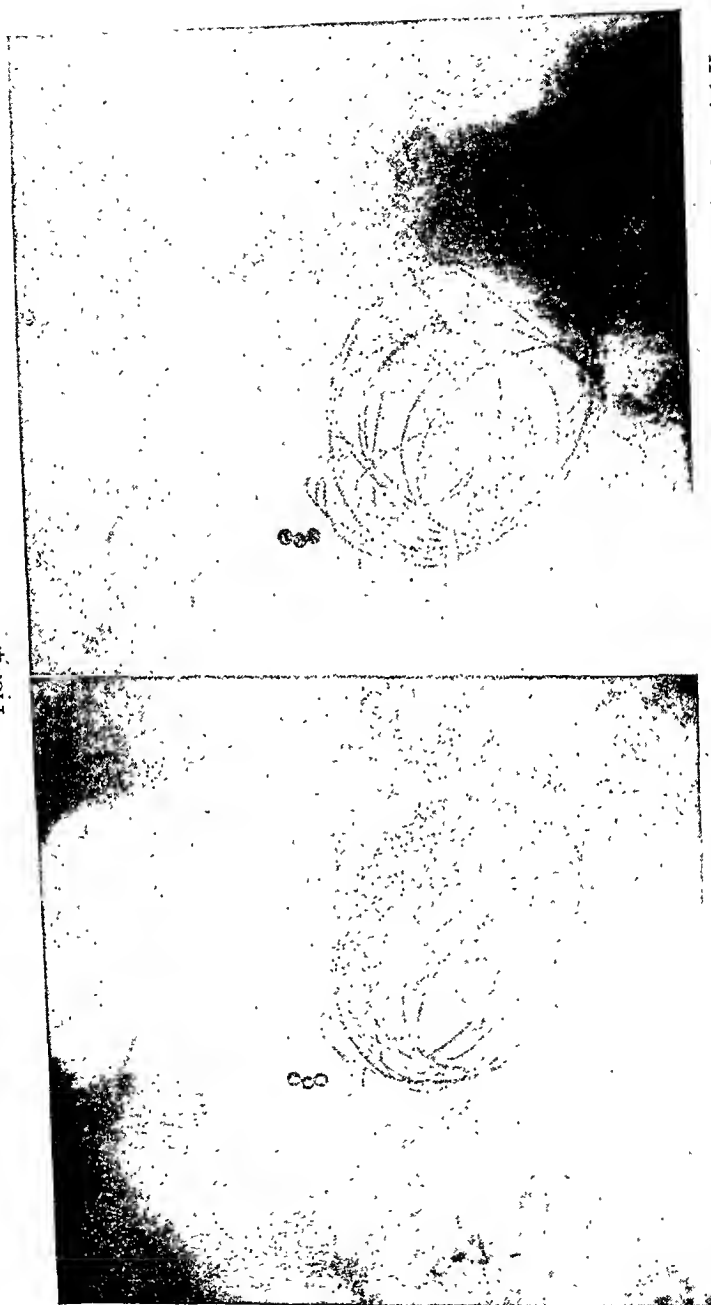
Same specimen as that in Fig. 1, showing appearance of the interior of the aneurism from the reverse side. There is seen the central projection of laminated fibrin supported in a snarl of wire, arising from the basal mass which was deposited in the bottom of the recess of the aneurismal sac overhanging the clavicle. *F*, isolated loop of wire bound down to the intima by scar tissue.

FIG. 3.



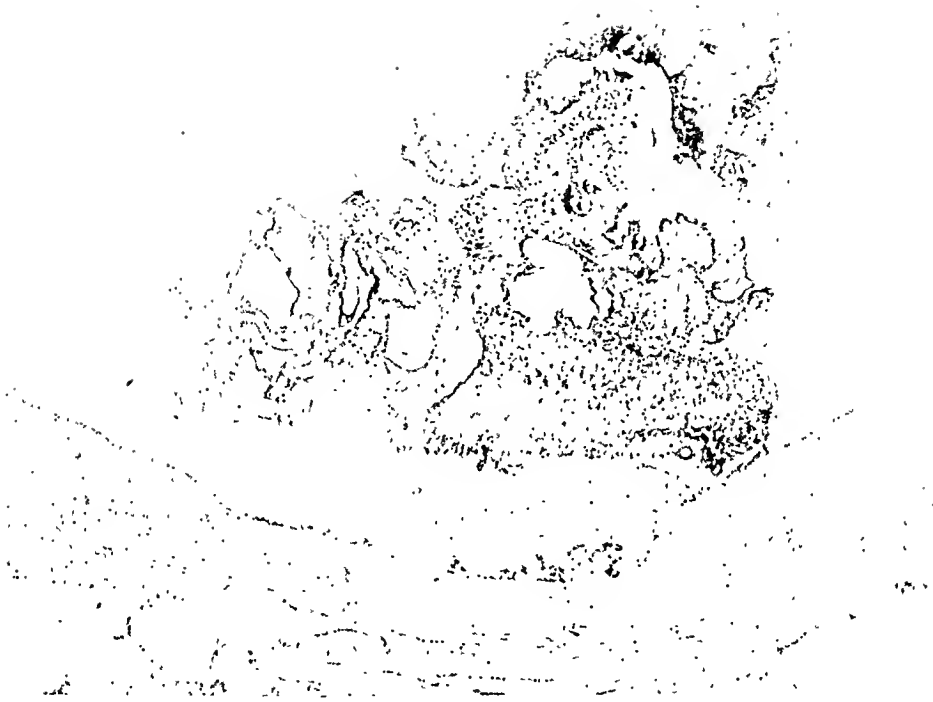
No. 28 gold platinum "Clasp" wire coiled for operation (see p. 793). The entering extremity of the wire was spirally shaped so that it could not go astray beyond the limits of the aneurismal cavity nor impinge directly against the sac wall. In order that the coiled loops should not get snarled before using the wire, they were bound together over a short segment of each coil by another piece of wire turned spirally around them, and the spirally shaped extremity was hooked into one of the turns. This fixation of the loops by the binding wire was in this instance done after the photograph had been taken. The spacing between any two of the longer lines on the ruler is $\frac{1}{4}$ inch. The length of the coiled wire was about $10\frac{1}{2}$ feet.

FIG. 4.

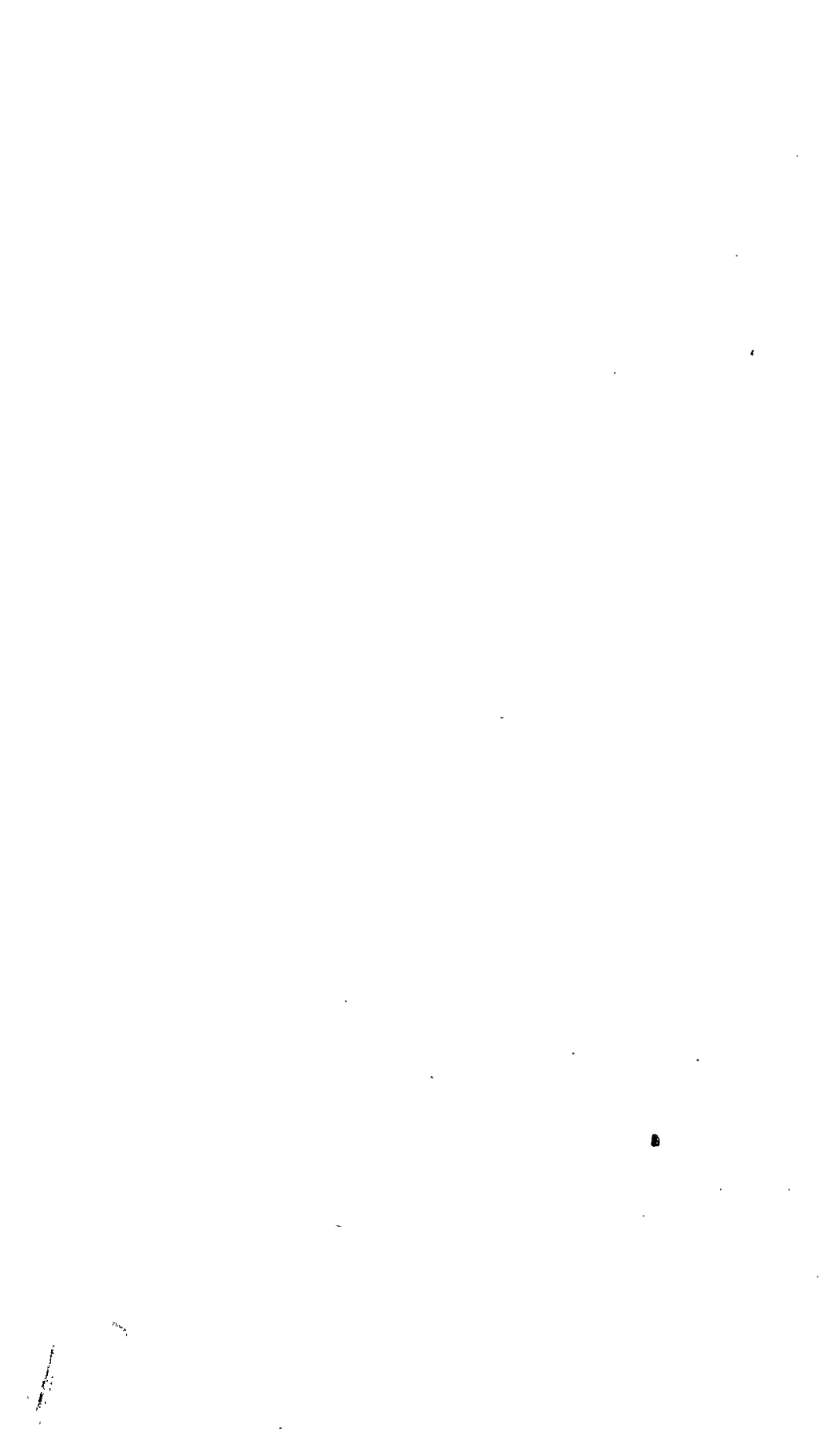


Stereoscopic X-ray photograph of the wire *in situ*, taken by Dr. L. T. Le Wald at the Edward N. Gibbs Memorial X-ray Laboratory, 3 months after the operation. If the picture be viewed through a stereoscope (an ordinary hand one is suitable), it will be seen that the loops of wire form essentially a globular skeleton framework which evidently outlines the limits of the sac, thus demonstrating the principle of contact of the wire with the lining of the aneurismal cavity.

FIG. 5.



Shows a microscopic specimen taken from the aorta of a dog which had been killed at the termination of the wiring operation in which the electric current had been used in the strengths successively of 100 ma., 50 ma., 40 ma., 30 ma., each for 15 minutes, which demonstrates the primary agglutination of the fibrinous clot to a site of trauma of the intima. $\times 26$.



At two other situations, loops of wire were bound firmly to the intima by scar tissue apparently (specimen disarranged by dissection) uncovered by any appreciable deposit of laminated fibrin (Figs. 1, *D*, and 2, *F*). The loops of wire examined that lay against the intima buried in the laminated fibrin, were not united to the intima by scar tissue. The sites of binding the wire to the intima by scar tissue without deposit of laminated fibrin seemed to be in regions where the blood current would have been swiftest. Many centrally located loops of wire presented themselves free from fibrin and untarnished. These findings seemed to designate loops of wire in relation with the sac wall as the causative factor in the deposit of the peripheral laminated fibrin, and the rather closely snarled loops of wire projecting centrally therefrom, perhaps through their slowing the blood stream, as the cause of the augmentation of the fibrin deposit in an inward direction. Thus in this case the deposit of laminated fibrin over but a limited area of the sac wall, and the central projection therefrom of a mass of laminated fibrin occupying a comparatively small portion of the sac space, together with the binding of the wires to the intima by scar tissue in two places, was apparently all that had resulted from the operative procedures to give the patient considerable relief from very distressing symptoms. The growth of this aneurism could be but temporarily arrested as a result of operation.

It is of interest that at one of the four wirings practised on this case, when a No. 26 wire coiled in loops $1\frac{1}{8}$ to $1\frac{3}{8}$ inches in diameter was inserted, with repeated twistings so as to snarl it centrally within the aneurismal cavity, no benefit accrued to the patient.

These findings seemed to incline one to believe *that the desideratum to be attained in these cases was to get a good deposit of adherent fibrinous clot resulting from electrolysis, as well as of laminated fibrin, over as large an area as possible of the aneurismal wall, and for effecting such object it seemed proper that the wire should be gotten pretty extensively into contact with the intima so that the electric current could traumatize the latter in lines of rather close association. The*

principle of traumatizing the lining of the aneurismal cavity has seemed to the writer an important one, since, without it, the opportunity for the organization of fibrin is lacking.

The centrally projecting mass of laminated fibrin in the specimen suggests the possibility of producing an internal accretion to fibrin deposited peripherally within an aneurismal cavity, around a suitable nidus of wire.

If the complete obliteration of the aneurismal cavity is not produced unless enough wire be introduced centrally to slow materially the blood current, then the operation conducted with a peripheral arrangement of the wire would be as applicable to fusiform as to sacculated aneurisms.

If that portion of the arch of the aorta proximal to the openings of the carotid arteries is the seat of operation, the danger from cerebral embolism must be considered, since the fibrin primarily deposited on the loops of wire not directly associated with sites of trauma of the sac lining, later breaks free, leaving these portions of the wire bare. Salinger¹ reports a case of cerebral embolism on the third day after wiring a very large aneurism of the first part of the aortic arch. Recovery ensued.

Preparation for Operation: The Wire.—The sort of wire used by the writer is manufactured in size No. 11, and is designated by the manufacturer as gold platinum "Clasp" alloy wire (for assay see p. 802). A piece of the No. 11 wire of about 11½ inches in length, when drawn down to No. 28, will produce a strand about 50 feet long. The special qualifications of this particular kind of wire which make it adaptable to the technic here advocated are (1) its resiliency, which enables it to regain its original shape after passing through a straight needle, and (2) its immunity to any solvent action of the electrolysis.

The wire used on this case, a No. 28 Brown and Sharpe gauge, was, in accordance with the proposition outlined above of bringing as much of the wire as possible into contact with the inner surface of the wall of the sac, specially coiled

¹ Salinger: *Therapeutic Gazette*, July 15, 1903.

(Fig. 3), the first portion in 8 loops of a diameter of about 3 inches and the remainder in 8 loops of a diameter of about $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, the idea being that the larger loops should be of sufficient size to spring against the aneurismal walls, making a good contact with the latter, and that the smaller loops, after introduction, should be snarled by twisting the external end of the wire, and then, by tilting the needle, thrown against the inner surface of the prominent protruding portion of the sac. The attempt to place the latter loops with precision, however, could not be carried out, owing to the fixity of the needle in the tissues through which it passed.

The end of the wire to be introduced was shaped in a spiral so that it could not go astray into a communicating channel, and as well that its extremity could not impinge directly against the sac wall, which might result in subsequent puncture. The latter occurrence has happened in dogs.

In order that the coiled loops should not get snarled before using the wire, they were bound together over a short segment of each coil by a wire turned spirally around them, and the spirally shaped extremity was hooked into one of the turns. This fixation of the loops by the binding wire was done after the photograph had been taken, so that it does not show in the picture. To prevent snarling during the introduction of the wire, the spiral extremity, freed from its position of fixation, should first be started through the needle before the binding wire is removed from the coil, after which the binding wire should be removed, and then the loops can be kept from crossing one another by finger pressure over the site of binding the coil, which maintains the orderly arrangement of the loops so that they will unwind without tangling. The grip for holding the coil is that between the middle, ring, and little fingers and the palm of the one hand, which leaves the thumb and index-finger free for assisting the other hand with the manipulations of the wire. As the wire thus held is now introduced, it uncoils from off the hand after the manner of uncoiling a rope. This transmits a twist through the introduced wire with the passage of each loop, which, through the resiliency of the wire, enables the loops to re-form within

the sac. This technic of passing the wire through the needle should be practised in the open previous to operating. For a right-handed operator the spiral extremity must turn in the direction seen in Fig. 3. The hooking of the spiral extremity through one turn of the binding wire to prevent snarling of the wire before operation is important, since if this extremity crosses one loop of the coil, the uninterrupted uncoiling of the wire will be interfered with.

The shaping of this gold platinum "Clasp" wire in coils of the desired size is very laborious, and one cannot engage to operate at short notice unless the wire is already prepared. A circle of the selected size drawn on paper can guide the shaping of the loops, and a light weight laid across the loops as each succeeding one or two are formed facilitates the progress of the work. It is not necessary that the coiled loops should lie perfectly flat. In fact, an occasional change in the direction of the curvature sufficient to cause some riding up of a loop away from the horizontal plane is of advantage, since such deviation favors a spreading apart of the loops after their introduction within the aneurism.

The *needle* was of gold insulated with a covering of porcelain enamel, of a calibre just enough larger than the No. 28 wire to allow the free passage of the latter without friction, which relation in sizes enables the hemorrhage through the needle to be arrested by the passage of the wire. A needle with too small a bore, through which the wire can be passed only with friction, should be guarded against on account of the liability of kinking of the wire, just as much as one with so large a bore as to permit free hemorrhage with the wire threaded through it.

Both needle and wire were boiled in a 2½ per cent. solution of sodium carbonate siccum in distilled water, but since this case was operated upon, experimental work has shown that it is better to omit the alkali.

The *current* (see p. 803), which should be direct, was taken from the illuminating fixture through a rheostat.

The *operating table* should be comfortably cushioned and covered with a rubber sheet.

Operation, November 24, 1911.—The needle, entering through a short skin incision, was made to puncture the aneurism near the eroded edge of the sternum, a little to one side of its most prominent portion, so as to avoid a thinned part of the sac. The three-inch diameter loops were first fed in from off the hand after the manner of uncoiling a rope. These larger loops of the wire encountered considerable resistance from the walls of the aneurismal cavity, which seemed to show that they were of a diameter greater than that of the sac. The smaller loops were fed in like the line off a reel and then the external wire twisted twice to try to snarl them. (This technic was here in error for the accomplishment of the purpose mentioned, since, with the introduced portion of the wire fixed within the aneurism, the further feeding in of the coil by unreeling would not permit of the loops re-forming after passing through the needle.) About $10\frac{1}{2}$ feet of wire were introduced. The positive pole was connected with the external end of the wire, which latter trailed over a piece of rubber dam. A felt electrode, 12 x 10 inches, backed with rubber, saturated in a 10 per cent. salt solution, to the upper margin of which, at about the level of the root of the neck, the negative pole was attached, had at the start been placed against the patient's back so as to include the area corresponding to the aneurism.

The current used on this case was determined as the result of experiments on 117 dogs. It was raised in two minutes' time to 75 ma. which was maintained for 15 minutes. Then it was reduced to 50 ma. for 15 minutes, 40 ma. for 15 minutes, and 30 ma. for 15 minutes, and then discontinued. The greatest strength of current was employed at the start, in order to cause a primary injury of the lining of the aneurismal sac at the sites of contact of the wire.

In this connection it may be stated that in the course of wiring an additional 34 aortas in dogs since operating on this case, it has been found preferable to start the current at 100 ma. and then drop to 50 ma., 40 ma., and 30 ma., each for 15 minutes, with which technic the injury to the intima at the sites of contact of the wire was a little greater than when the current was raised to only 75 ma., and besides, the fibrin deposit at these sites of injury was a little greater in amount, firmer in consistence, and more strongly adherent to the arterial wall than with the weaker current. The practical superiority of the use of the stronger

current would seem to be supported by the result of its application to three cases of thoracic aneurism operated upon very recently, in all of whom the diminution in the pulsation was noticeable to the patients within eight hours following the operation, which is in contrast to the observation by the patient here reported that pulsation did not markedly diminish until the tenth day.

At the end of the electrical séance on the patient, the wire was first loosened within the needle, and then the needle was withdrawn over the wire held firmly in position. There was no hemorrhage from the puncture, and the wire was pulled out a little until the resistance of the fibrin covering its inner portion was felt, and was then cut off in the bottom of the wound.

Subsequent Course.—The constant pain was relieved promptly following the operation, but on coughing the patient had considerable pain at the seat of the fracture of the sternum. Prompt diminution of pain following this operation has been noted by Hare.²

On November 28 at 2 A.M. (fifth day) the patient had a sudden pain in his chest of great severity, which was much relieved by removal of a plaster strapping which had been placed around his fractured sternum. The tumor coincidentally had become more prominent, some of which swelling, anyway, was due to œdema.

The acute pain rapidly subsided, and on the following day, November 29, he had pain only on coughing, and he coughed less than before.

December 3 (tenth day): Pulsation for the first time was found to be markedly diminished. The change seemed to have come rather abruptly during the night. The patient himself had noticed it.

December 18, 1911 (twenty-fifth day): Patient has been up several days. He has no cough whatever. The tumor is little expansile. Occasional shooting pains in left nipple and inner side of the left arm. Up to this time during his stay in the hospital he has had no potassium iodide or mercury, which drugs were now administered.

February 28, 1912 (three months)³: The patient says he

² Hare: *Therapeutic Gazette*, 1908, p. 254.

³ May 11, 1912 (latest observation): The patient feels perfectly well, has no pain, and no shortness of breath unless he walks very fast. He walks about a mile every day. Occasional dry cough. There is a little increase in the force of the pulsation, which has varied in amount at different times. This change was first observed by the patient about March 6, soon after which the pulsation was observed to be of con-

can walk upstairs with perfect comfort, and that he feels perfectly well. No pain. The superficial tumor is practically obliterated, evidencing shrinkage of the sac. Pulsation can still be felt, though but very little expansile, and a bruit is still heard, showing that the sac is not obliterated. The aneurism reached its present state of quiescence about eight weeks after the operation. Very occasional dry cough.

A stereoscopic X-ray picture of the wire *in situ*, taken February 27, 1912, by Dr. L. T. Le Wald, at the Edward N. Gibbs Memorial X-ray Laboratory, here reproduced (Fig. 4), demonstrates the loops of wire forming essentially a globular skeleton framework, which evidently outlines the limits of the sac. Thus the principle of contact of the wire with the lining of the aneurismal cavity is seen to have been carried out in this case through the technic employed.

PRINCIPLES OF THE TECHNIC HERE ADVOCATED.

These principles were formulated as a result of observations on the previous case of innominate aneurism, the case here reported, and three other very recent cases, besides the experimental work on the 151 dogs.

1. The wire should be one having the properties of the gold platinum "Clasp" alloy (p. 802), viz., it should be resilient and it should not dissolve under the influence of the electrolysis. The resiliency enables the loops, with proper technic, to re-form within the aneurism, so that the disposition of the wire is more or less under the control of the operator.

In contrast to this wire, a silver wire alloyed with $7\frac{1}{2}$ per cent. copper (Hunner⁴ and Finney⁵) is not resilient, and under the influence of an electric current fluctuating between 35 and 50 ma. in the blood stream of a dog's aorta for 48 minutes it corroded, dwindling to about one-third its original size, and broke spontaneously at a

siderable violence. By April 20 there had been a slight return of symptoms, at which time the patient confessed that he had been indulging rather freely in the use of tobacco. On stopping the tobacco the symptoms promptly subsided. The aneurism has become a little prominent again.

⁴Hunner: Johns Hop. Hosp. Bull., xi, 1900, p. 263.

⁵Finney: ANNALS OF SURGERY, lv, 1912, p. 661.

point outside the artery where it lay in clotted blood. The clot deposited on this wire was fibrinous. Another wire of 12 carat gold, the alloy of which could not be determined, under the influence of a current around 50 ma. for 85 minutes, similarly corroded and broke outside the aorta of a dog, and on removal of the specimen the intra-aortal portion of the wire fractured into fragments. The clot in this case was very large in amount, dark red in color, and not at all fibrinous but of a clay-like or doughy consistence. Along the site of the wire this clot presented a metallic stain. The question would arise whether a pasty coagulum of this sort resulting from the use of a particular kind of wire would be capable of undergoing organization. This decomposition of the wire under electrolysis may elucidate happenings like those reported by Willson⁶ and by Hare⁷. In the former's case the X-ray showed no trace of any wire. The wire, probably a gold one, under the influence of a current of 20 ma., had burned off during the operation and Willson believed it had been destroyed by the current. In Hare's case, at autopsy four months following the operation, there was no trace of 18 feet of gold wire which had been introduced into an innominate aneurism.

2. The wire should be made to come as extensively as possible into contact with the lining of the aneurism, so that the electric current can injure the same, thereby producing areas for the adhesion and organization of the fibrinous clot deposited by the electrolysis along the contiguous portion of the wire, as well as for the deposit and organization of laminated fibrin.

In attempting to bring as much of the wire as possible into close relation with the inner surface of the aneurismal wall, the problem is a little complex because of the inability to determine definitely the diameter of the aneurismal cavity from which to gauge the size to coil the wire. The percussion note and the X-ray shadow will contribute some information.

⁶ Willson: Trans. Coll. Phys., Phila., 3, S, 1908, xxx, p. 33.

⁷ Hare: Trans. Coll. Phys., Phila., 3, S, 1908, xxx, p. 28.

Borne out by the result in the case here reported, it would be well if the diameter of the loops of the wire as coiled before operation could a little exceed the diameter of the aneurismal cavity. If at operation this disproportion in size is found to be reversed, the diameter of the cavity being greater than that of the loops, as evidenced by the fact that the wire feeds in freely through the needle without encountering the resistance of an opposing surface, then it is the writer's proposition to give the external portion of the wire extra twists in addition to those which occur naturally from the uncoiling of the wire from off the hand, seeing to it that the former twists are made always in the same direction as the latter. This manœuvre, through the resiliency of the wire, should throw apart the loops which have passed through the needle, snarling them into a skeleton framework of a greater diameter than the diameter of the original coil, so that the peripheral loops would then make a good contact with the walls of the aneurism.

The writer is inclined to believe that for all but very large aneurisms, the slender No. 29 filament coiled in large loops can be used to advantage. A sizable loop of this wire ought to be able to adjust itself within the confines of an aneurismal cavity of a much smaller diameter than its own, without risk of causing pressure necrosis. A No. 29 wire coiled in loops varying in diameter between $4\frac{1}{2}$ and $5\frac{1}{2}$ inches, on being introduced into a globular flask $3\frac{1}{4}$ inches in diameter, readily took a peripheral arrangement around the inside of the vessel. Thus this size wire thus coiled might be used for any aortic aneurism of a diameter less than that of its own loops.

3. The introduced extremity of the wire should be spirally shaped for the reasons already given (Fig. 3).

4. Unless the insulated gold needle be known to be made of an alloy which is not decomposed by electrolysis, it would be as well to test it in a dog before use on a patient.

5. In case the needle is likely to have to make a deep puncture to reach the interior of the aneurism, it can, before its introduction, be pricked through a little square of rubber

dam, which will insulate its outer extremity should the latter come into contact with the superficial wound.

6. The needle and wire should be boiled in distilled water.

7. The negative electrode should be placed against the back directly over the area corresponding to the aneurism and should more than cover this area. The writer, for use on the patient, attached the negative wire at the upper edge of this electrode, but he now believes that theoretically it should rather enter at the centre of the latter just opposite the aneurism. Dr. Homer F. Swift made the suggestions that the size of the area covered by the indifferent electrode and the relation of the negative to the positive pole probably made a difference in the evenness of the clot formation along the wire in the blood stream. The experimental results confirmed the truth of the suggestions. When a small area of the animal's back was shaved for contact with the negative electrode, the clot formation along the wire was very irregular, but when the whole back from neck to hips was shaved and the animal laid on a 14-inch long electrode, the results were notably improved. It was further noticed that if the site of attachment of the negative wire to the electrode were at a low point of the back opposite the site of entrance into the aorta of the gold wire, to which latter the positive pole was attached, the inner extremity of the gold wire lodged near the arch of the aorta would be scantily coated with fibrin, but that with the position of the electrode reversed so that the site of attachment to it of the negative wire came about opposite the arch of the aorta, then the inner extremity of the wire would receive a greater amount of fibrin deposit. These effects can be explained by the fact that the electric current passes through the body with greatest intensity in the line of the shortest distance between the two poles, and the whole length of the wire lying in the aorta is consequently acted upon evenly only when the poles are placed at its opposite ends.

8. It is as well that the external portion of the wire during the passage of the current should trail over a piece of rubber dam.

9. The principle in the use of the current as here set forth is to begin with a high current (100 ma. for 15 minutes, raised to this point at the start in 2 minutes' time), which will to a sufficient degree injure the intima at the sites of contact of the wire, and then lower the current to the strengths successively (50 ma., 40 ma., 30 ma. each for 15 minutes) which were found in the experimental work to be the combination most favorable for the production of a firm fibrin deposit that would become adherent to the sites of trauma during the passage of the current (Fig. 5). In the experiments where the 100 ma. current was used at the start, it was found that the fibrin deposit on the wire at the sites of trauma of the intima would be greater in amount than that in the intervals.

10. *The control of hemorrhage.* The site of puncture should be at a thickened portion of the aneurismal wall rather than at a thinned portion. The needle should be of a calibre just enough larger than the wire to allow the free passage of the latter without friction, which relation in sizes enables the hemorrhage through the needle on its introduction to be arrested by the passage of the wire. On the withdrawal of the needle, when the puncture has been made through a thickened portion of the sac wall, the hemorrhage seems to become easily self-arrested, particularly if the wire be pulled gently outward until the fibrin-covered portion within the sac, just beyond that which had been sheathed by the needle, is felt to have been drawn firmly against the interior aspect of the puncture. In case, for any reason, on withdrawal of the needle a free hemorrhage should arise which would seem unlikely to be controlled by ordinary measures, the writer would suggest, before cutting the wire off, the starting up of the electrical current again at 50 ma. In most of the animal experiments the needle was withdrawn from the aorta immediately after passing the wire, with resulting free hemorrhage from the puncture, which, temporarily arrested by the gloved finger, could invariably be controlled by a 50 ma. current, usually within 3 minutes' time and rarely in longer than 9 minutes. In four recovery experiments where this technic was employed (the puncture being unprotected by any in-

sulation throughout the electrical séance), and the wire was left protruding through the puncture at the end of the operation, the puncture was found at autopsy to be tight. One of these animals (highest strength of current, 50 ma.) was autopsied on the fifth day after operation, another (highest strength of current, 75 ma.) on the fourth day, and two (highest strength of current, 100 ma.) after 10 and 12 weeks respectively. In both of the latter the wires had shifted from their original positions, each having worked back through the puncture for about 2 inches into the subperitoneal tissues, where the extruded portion was found encased in scar tissue.

II. It is a well-established principle that the positive pole should be attached to the gold wire and the negative pole to the electrode against the back. In a dog with the current reversed, the negative pole being attached to the wire in the aorta and the positive pole to the electrode against the back, neither trauma of the intima nor the deposit of any fibrin along the wire took place.

SOURCES OF TROUBLE.

The Wire.—The right kind of wire has recently been difficult to get, until its identity with the gold platinum "Clasp" alloy was established. In order that any scientific value which his work might possess should not be nullified by a possible disappearance of this particular brand of wire from the market, the writer has had a piece of the gold platinum "Clasp" wire assayed, and it is reported to be made up of the following alloy: gold, 62.9 per cent.; silver, 17.9 per cent.; platinum, 13.4 per cent.; copper, 5.8 per cent.

The drawing of the wire to the proper fineness is difficult, as the wire is very liable to break during the procedure, and the required length may be forthcoming only after much patient work. This is particularly true in drawing the wire down to size 29.

The coiling of the wire as here suggested is laborious.

Unskilled hands may inadvertently snarl the wire, so that personal supervision of the handling of the latter is recommended.

The Needle.—The needle is very liable to get plugged by the clot which forms within it alongside the wire, which complication can take place in the following wise: If the external piece of wire over which the needle is threaded at the end of the operation be withdrawn without first cleaning the bore, it will be found that on reintroducing the wire through the needle the débris within the lumen will be jammed together into a solid mass which can be removed only by drilling. Drilling necessitates breaking of the porcelain enamel covering, and to effect re-enamelling special furnaces and special skill are required. To avoid this series of complications, the piece of wire left threaded through the needle at the end of the operation should not be withdrawn until it has first served the purpose of cleanser by being pulled alternately in opposite directions through the bore of the needle, after first soaking the latter with the wire threaded through it in cold water. A blow upon the needle, such as that received as a result of letting it drop upon a hard floor, will also chip off the enamel.

Electrical Current.—The electrical current taken from a storage battery is very liable to lose in intensity during the period of its use, and is very sure to do so if the battery has not been freshly charged. The direct current taken from an electric fixture through a rheostat gives a steady flow. With the use of the rheostat certain precautions should be taken to prevent short-circuiting, which, if it occurs, will disable the instrument. It is therefore recommended that the current be not turned on at the socket in the fixture until all the manipulations of the wires connected with the rheostat be completed. Also that when the electrical séance is finished, the connection at the socket should first be interrupted before the wires are again handled.

All the wire connections should be made tight before starting, since a loose connection might interrupt the current, which would result in giving the patient a shock. Also the main switchboard should be carefully guarded, lest, during the séance, some one should inadvertently shut the current off.

If the rheostat be used, it would be well to have an extra one in reserve.

ADHESIONS OF THE UPPER ABDOMEN.*

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ON account of changes in position of viscera at different stages of development of the embryo, the peritoneum seems peculiarly apt to retain anomalous features, after following organs to their permanent sites. Folds which ordinarily undergo obliteration before the birth of the child, sometimes remain as permanent defects. An organ as large as the liver, with its long and tortuous course to position in permanent site, seems to carry in its vicinity more defects of the peritoneum than are found with other organs from the endoderm. The gall-bladder and the cystic duct may retain a complete post-natal mesentery, consisting of a double serous fold enclosing blood-vessels and nerves, and which persists through adult life. Lesser defects are frequently shown in abnormal bands of the gastrohepatic omentum or of the gastrosplenic omentum. The right free margin of the former connects the liver and duodenum, and may form a short but strong ligament sufficient to angulate the duodenum in a way to give a radiographic picture suggestive of undue fixation of the pylorus and first part of the duodenum. Many small anomalous peritoneal bands remain between various parts of the liver, parietes, and upper abdominal organs. These peritoneal defects seem to be caused by lack of normal adhesion of apposed peritoneal surfaces during fetal development.

Reference to the presence of peritoneal abnormalities in the upper abdomen, due to lack of normal adhesion of surfaces in fetal life, is introduced in a preliminary way in this paper, for purposes of contrast with peritoneal adhesions developed in post-natal life as a result of inflammatory processes.

* Read before the New York Surgical Society, March 13, 1912.

It is probable that embryonic peritoneal defects cause little disturbance of function of organs, because of compensatory changes which take place in the course of development. It is certain, on the other hand, that defects of post-natal inflammatory origin may cause serious disturbance of function of viscera. The importance of distinguishing between developmental defects of embryonic origin and defects of post-natal inflammatory origin will impress one more and more as he makes notes relating to the subject. In the early stages of observation, there is sometimes difficulty in distinguishing between the two kinds of defect, but one soon learns to know them apart. A certain definiteness in outline of the congenital defects, with an order of arrangement harmonious with the anatomy of the region, is in evidence, and these embryonic derelicts commonly have a smooth covering of endothelium. Abnormal peritoneal bands of congenital origin often contain adipose inclusions, or may even carry fatty appendages. Post-natal inflammatory defects of the peritoneum give one the impression of disharmony with the general anatomy of the region. Their surfaces may be covered with endothelium, much like that of the normal peritoneum, but there is a suggestive irregularity in form and position of adhesion bands, and they do not contain adipose inclusions.

Congenital peritoneal defects and acquired inflammatory defects not infrequently occur together in the same individual, but the acquired defects of inflammatory origin are apparently the only ones with which surgeons need to deal in work in the upper abdomen. If the Lane's kink escaped observation for so long a time, and if so small a defect is now known to give rise to such well-marked symptoms, one may readily assume that still more extensive adhesion defects in the upper part of the abdomen give rise to more complicated kinds of disturbance. These adhesions, to which I referred some years ago as "cobwebs in the attic of the abdomen," are still generally overlooked by diagnosticians and in post-mortem examination, in very much the same way as we overlooked ad-

hesions in the region of the appendix until the attention of the profession was turned to the subject of appendicitis, twenty-five years or more ago.

The first observation made by the author relating to adhesions in the upper part of the abdomen led to the conclusion that they proceeded from toxic influences associated with the bile tract. It seemed probable that bacteria carried to the liver by the afferent vessels of the portal system, and excreted by the liver, made demonstration in the vicinity of the bile-ducts, either through the influence of toxins escaping through the thin-walled ducts, or through the activities of bacteria remaining and undergoing development in this region. A later view seemed to include the idea that toxic processes influencing the peritoneum of this region were not confined to bacteria or toxins arriving by way of the liver. There seemed to be in addition, toxic impression made by bacteria in the vicinity of the pylorus and duodenum in cases in which no such definite lesion as ulcer had been present. As yet it is difficult to state whether this impression is made by bacteria on the mucous surface of structures in the vicinity, or by bacteria actually escaping into the peritoneal cavity. The idea that bacteria may escape into the peritoneal cavity in this region bodily, seems to be upheld by the finding of bacteria resembling the colon bacillus enmeshed and latent in adhesion tissue of the region.

Adhesions are probably formed after toxic desquamation of endothelium. Plastic lymph exudate then becomes organized and remains in the form of adhesion tissue, binding various structures together. No matter in what way inflammatory adhesions are formed, there is introduced a mechanical obstruction to peristaltic motility of hollow viscera engaged in adhesions, and there is interference with the movement of one viscus upon another in the adjustments which occur momentarily with ordinary movements of the body. The hyperplastic connective tissue resulting from organization of lymph exudate undergoes contraction characteristic of such tissue at some points, or it may be pulled out into long bands.

The latter have a tendency to undergo absorption, unless there is renewed adhesion formation in the vicinity from time to time. No doubt such renewed inflammatory process is common to most of the cases in which upper abdominal adhesions occur. This assumption is based upon the belief that toxic impression upon the peritoneum occurs in patients with defective digestive processes, and that adhesions once they become established exert a retroactive influence; that is, faulty digestive processes allowing toxic impression to be made upon the peritoneum of the upper abdomen in the first place are subject to still further derangement through the mechanical influence of acquired adhesion later.

The symptoms belonging to adhesions in the upper abdomen are apt to lead to a diagnosis of some other condition; for instance, we may have angulation of or interference with the cystic duct of the gall-bladder, requiring spasmodic action of the gall-bladder to force contents past the obstruction. In such a case the symptoms may be those of gall-stones. Adhesions interfering with the common bile-duct may even lead to jaundice, although this symptom is not so common as the symptom of spasm in the effort of the gall-bladder or bile-duct to force bile past points of obstruction. Very many patients have been operated upon who presented a fairly clear history of the presence of gall-stones, and yet no gall-stones were found at the operation—nothing but adhesions in the vicinity. Adhesions interfering with peristalsis of the pylorus and duodenum may give rise to symptoms closely simulating those of ulcer of these regions. The author has under his care at the Post-Graduate Hospital at the present writing, a man who gave a good history of duodenal ulcer, according to careful tests made by expert diagnosticians in this special field, and yet at operation nothing was found excepting extensive adhesions in the vicinity of the duodenum. The duodenum on being opened showed no sign of ulcer and no induration of its walls. The case was typical of a number seen by the author. In this case we noted the enlarged lymph-glands of the pancreas belonging to pancreatic lymphangitis,

as recently described by Deaver. Such pancreatic lymphangitis is probably only one result of the local toxic processes which lead to adhesion formation.

Persistent hyperchlorhydria is a feature in the history of these adhesion cases. Abnormal retention of food in the stomach is noted, and fluoroscopic examination may show fixation of the pylorus or of the free part of the duodenum, and interference with the peristaltic wave. There may be rigidity of the upper part of the rectus muscles, tenderness on pressure at Robson's point, hyperæsthesia in the gastric zone of Head, and yet nothing more than adhesions found at operation. There is absence of blood from the stomach or bowel, and that is sometimes the only feature of distinction in a clinical way between the condition of adhesions and the condition of ulcer.

At the present moment the author has no data referring to the influence of adhesions upon the pancreas, but it is fair to assume that some of the cases of pancreatitis, acute and chronic, may be due to mechanical interference with the pancreatic duct.

Adhesions interfering with duodenal peristalsis or with colonic peristalsis, when they extend to engage the hepatic flexure of the colon, as often enough occurs, seem to lead to more or less intractable constipation. The acute stages of inflammation leading to adhesion formation may be definite at the time when we have such acute infection of the upper abdomen. They may be subacute at the time when we make a diagnosis of gastroduodenitis or catarrh of the bile-duct. They may be insidious when the patient complains of nothing more than a persistent unaccountable tenderness in the epigastric region. At all such times we assume that toxic desquamation of peritoneal endothelium may be under way, and that adhesions are in process of formation.

Aside from mechanical interference with peristalsis of the hollow viscera, we may assume that disturbances of secretion and excretion result from the presence of adhesions in some cases. Derangement of hormone secretion at the pylorus, due

to adhesion irritation, might lead to various gastric disturbances, ranging from rather intractable dyspepsia of low grade up to acute indigestion, but the derangement of hormone secretion doubtless belongs more properly to the acute toxic stages.

It is possible that we may place all this local irritative influence back upon the responsibility of the liver after all, and find that infection in the vicinity of the exit of the common duct is due to excess of toxins at this particular point, just as a stream is most cloudy at the point where a sewer discharges. Features associated with infections in other parts of the abdominal cavity indicate that such may be the case. When we have, for instance, appendicitis and simultaneous cholecystitis or simultaneous ulcer of the stomach, it would seem to indicate that the greater the proportion of toxins excreted by the liver, the greater the proportion of cases of cholecystitis and ulcer of the stomach occurring synchronously. Infection having led to adhesion formation, adhesion formation leads in turn to disability of affected organs, leaving them more vulnerable to subsequent infection.

The degree of adhesion formation present in any given case cannot be foretold by the symptoms. The author has found pylorospasm, dilatation of the stomach, and grave digestive disturbance, when a comparatively small band of adhesions has engaged the duodenum. At other times nothing more than indefinite dyspeptic symptoms have been present in cases where a very large area, including the duodenum, pylorus, colon, bile-duct, and liver, was engaged in adhesions. The response of the individual patient then, to the influence of adhesion irritation, interferes with the value of testimony relating to the extent of adhesions in his case.

Periodicity of symptoms is quite as well marked in simple adhesion cases as it is in cases of ulcer of the duodenum.

Patients will suffer from acute digestive disturbance, passing into the chronic stage. They may have hyperchlorhydria or hypochlorhydria, which will clear up under medical treatment, and the patient then enjoys a fair degree of health

until the next attack. This history of periodicity of acute attacks of disturbance with adhesions is so closely that of the history of ulcer of the duodenum that we shall probably have difficulty in making differential diagnosis excepting at operation, and perhaps even then. If adhesions and ulcer are found together we cannot know which feature was the dominant factor in symptom production.

Treatment of adhesions consists in separation and the adoption of methods for preventing their recurrence. My own practice has been to stop at this point in operating when there was no history of blood in stools or stomach, and no point of induration suggestive of ulcer or ulcer scar.

In cases in which we have blood in stools or stomach, or induration of walls of viscera, appropriate steps are taken in addition to adhesion separation.

For preventing recurrence of adhesions several resources are of value. When adhesions have been separated over a small area and there is not much oozing of blood, aristol dusted upon the region and allowed to remain for a moment, until lymph coagulum has formed, is beneficial.

When there is a considerable degree of oozing after separation of adhesion surfaces, sheets of Cargile membrane may be used, the difficulty here being to place the membrane properly, as this tissue is not easily handled with moist fingers. It is best managed by laying it first upon a square pad of dry gauze, pressing gauze and membrane together upon separated adhesion surfaces, and then removing the gauze quickly at the moment when viscera fall back into place.

A third resource consists in smearing recently separated adhesion surfaces with sterilized vaseline. This resource is employed in cases in which for any reason there is difficulty in obtaining an aristol-lymph coagulum, or in covering widely separated adhesion surfaces with Cargile membrane.

Surgical methods for preventing recurrence of adhesions are mechanical in nature, and relate to the date of operation. We must bear in mind the probability that the original tendency to adhesion formation still remains with the patient, unless disorders of digestion are taken in charge by the physician.

INVOLVEMENT OF REGIONAL LYMPHATIC GLANDS IN CARCINOMA OF THE STOMACH.

FROM A STUDY OF 200 RESECTED SPECIMENS.

BY WILLIAM CARPENTER MacCARTY, M.D.,

ASSISTED BY

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AN historical review of gastric therapeutics should give the surgeon credit for having demonstrated that all palpable tumors of the stomach are not inoperable, a fact learned from experience in palliative surgery, especially in cases in which the surgeon tried to save the patient from starvation by resection or gastro-enterostomy. Patients with extensive lesions in the stomach often lived comfortably over a period of several years. This was far beyond the expectations of the surgeon.

Such clinical and operative experience and the close association of carcinoma with gastric ulcer—which has been demonstrated by the surgical pathologist—have led conservative but progressive surgeons to explore, in doubtful cases, rather than to guess about the abdominal contents. Many cases which were considered clinically “inoperable” have been found to be operable; many carcinomatous stomachs have been diagnosed clinically simple gastric or duodenal ulcers; many “gastric ulcers” have been found to be ulcers of the duodenum; and many lesions in the gall-bladder, duodenum, and appendix have been mistaken for gastric ulcers.

Recognition of the operability of cases, which a few years ago were considered inoperable, has been a great step forward in the art and science of operative gastric therapeutics. Some patients have been completely cured of gastric disturbances, many relieved for a period of years, and others saved from a death of starvation.

Good results have been doubtless due in part to irregularity in the rapidity of lymphatic involvement—a condition in gastric carcinoma which has occupied the attention of operators and pathologists since the pioneer days of gastric surgery. Lengemann¹ studied the regional lymphatic glands,* which were removed with specimens of carcinoma of the stomach in the clinic of Mikulicz. Renner,² in the same clinic, studied the lymphatic involvement in gastric carcinoma in 15 cases which came to autopsy. Cuneo³ studied carcinomatous stomachs from eight autopsies in cases which had not been operated upon, one case at autopsy in which a gastro-enterostomy had been done, and thirteen cases in which gastrectomy had been performed. The last observer paid special attention to the lymphatic system of the wall of the stomach and the lymphatic glands, which he studied by means of a modification of Gerota's⁴ method of injecting the lymph spaces and vessels (Fig. 6).

Lengemann¹ and Renner² charted the involved glands in a manner somewhat similar to that adopted for this series.

The material for this investigation, which is a continuation of a study made on gastric ulcer by the writer,⁵ consists of 200 specimens which had been resected or excised from the carcinomatous stomach. Each specimen was examined immediately after its removal and again in a fixed condition. The location and size of the primary lesion and the location and the relative size of the lymphatic glands of the lesser and greater curvatures were noted and recorded upon diagrams (see charts). One-half of each gland was numbered and fixed in 4 per cent. formaldehyde solution (10 per cent. formalin), frozen, cut, and stained with hæmatoxylin and eosin. All lymphatic glands were examined microscopically and the diagnosis recorded on its respective diagram (see charts). Lymphatic glands which were found to be inflam-

* The term "lymphatic glands (lymphoglandulæ)" has been adopted by the writer according to the nomenclature recommended by the "Anatomische Gesellschaft" at the ninth meeting in Basel and published under the title "Die Anatomische Nomenclatur (Nomina Anatomica)" by Wilhelm His,²³ Leipzig, verlag von Veit and Comp, 1895.

matory without carcinomatous involvement were examined several times in order to rule out the possibility of involvement in some other portion of the block than the one examined. Absolute accuracy would depend, however, upon serial section of each gland. This is not feasible in a large series of specimens. One thousand four hundred and four lymphatic glands were examined. During the microscopic investigation photographic records were made.

A clearer conception of the material of this paper may be obtained by first reviewing the results of a previous study by the writer⁵ of the same material to determine the character of the process of ulceration in the wall of the stomach. Two hundred and sixteen resected or excised specimens of the stomach were examined. These consisted of simple ulcers, ulcers associated with carcinoma, and carcinoma so advanced that its development upon ulcer could not be determined. In a study of this material it was seen that an initial erosion or partial destruction of the gastric mucosa occurred as the apparent forerunner of extensive ulceration. Why and how the initial disturbance occurred was undetermined. The process of destruction after the initial lesion had occurred was, however, apparent in many of its phases.

It has been shown that gastric ulcers sometimes become healed—scars of old ulcerations having frequently been found at autopsies in general hospitals. Why all gastric ulcers do not heal spontaneously remains an unanswered question. In the previous investigation it was noted that lesions apparently continued with gradual deepening of the ulcer. In many cases this seemed to occur very slowly or periodically. The chronicity of these lesions was shown from the fact that changes, such as the presence of dense scar tissue, lymphocytic infiltration, epithelial hyperplasia, and glandular distortion, occurred in practically all ulcers seen in the series. The clinical course of all cases which were studied also bore out their chronic character. It was also found that the base of a gastric ulcer might consist of any of the coats of the stomach (mucosa, muscularis mucosæ, submucosa, muscularis, subserosa or peritoneum). These were often greatly distorted

by marked inflammatory reactions. Various stages of extension of gastric ulceration through the wall may be seen in Figs. 1 and 2 (*a*, *b*, and *c*).

The border of the mucosa in such specimens was almost invariably hypertrophic, the gastric glands were distorted and often cystic or dilated (Figs. 3 and 4). The epithelial cells were in a condition of hyperplasia; in simple ulcers these cells had attained morphologic development and perhaps their physiologic differentiation. The last two features serve well as an aid in the differentiation between inflammatory or simple irritative epithelial hyperplasia, and the apparently morphologically undifferentiated and physiologically undifferentiated epithelial hyperplasia of carcinoma. In the latter condition the cells were found to be passing through stages similar to those described in carcinoma of the breast.⁶ They invaded surrounding tissues only when they were morphologically undifferentiated.

The underlying coats of the stomach and the base of the ulcer apparently became secondarily involved from some point in the mucosa. Epithelial cells apparently entered the lymphatic spaces of the mucosa and followed the channels described by Cuneo,³ Sappey,⁷ and Most.⁸

According to Cuneo³ the lymphatic space between the gastric glands (Fig. 6) are intercommunicating, form large spaces in the submucosa, pass through the musculature, collect in the subserosa, and enter lymphatic channels just under the peritoneum. This gastric intramural lymphatic system empties its contents into the extramural or regional lymphatic glands. The glands upon the specimens in this series are divided, according to Cuneo's classification, into the lesser curvature, subpyloric, retropyloric, and greater curvature groups (Fig. 5).

The relation of the primary lesion—carcinoma—to the amount of lymphatic involvement and the relation of these to the clinical histories were the objects of this investigation, which is a part of a general investigation by the writer of gastric ulcer and gastric carcinoma.

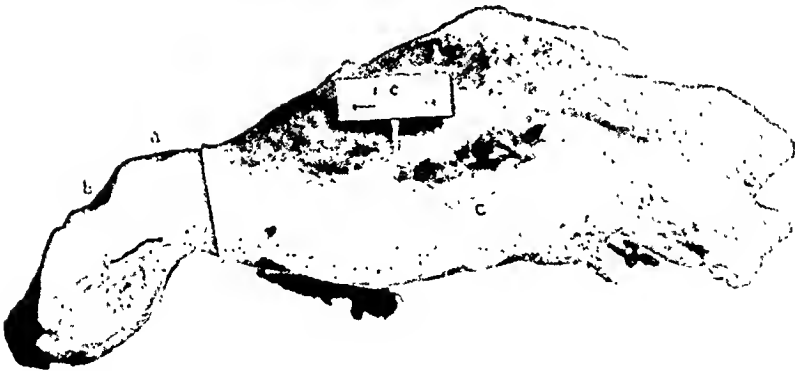
Primary lesions varied from 1 cm. to 14 cm. in diameter

FIG. 1.



Case 18088, Group III. Multiple gastric ulcers, showing them in various stages.

FIG. 2.



Case 18088, Group III. Gross section through the ulcers in Fig. 1. *a*, small ulcer of the mucosa; *b*, ulcer invading the submucosa; *c*, largest ulcer showing the dense scar tissue in the muscular wall and extending to the serosa.

FIG. 3.



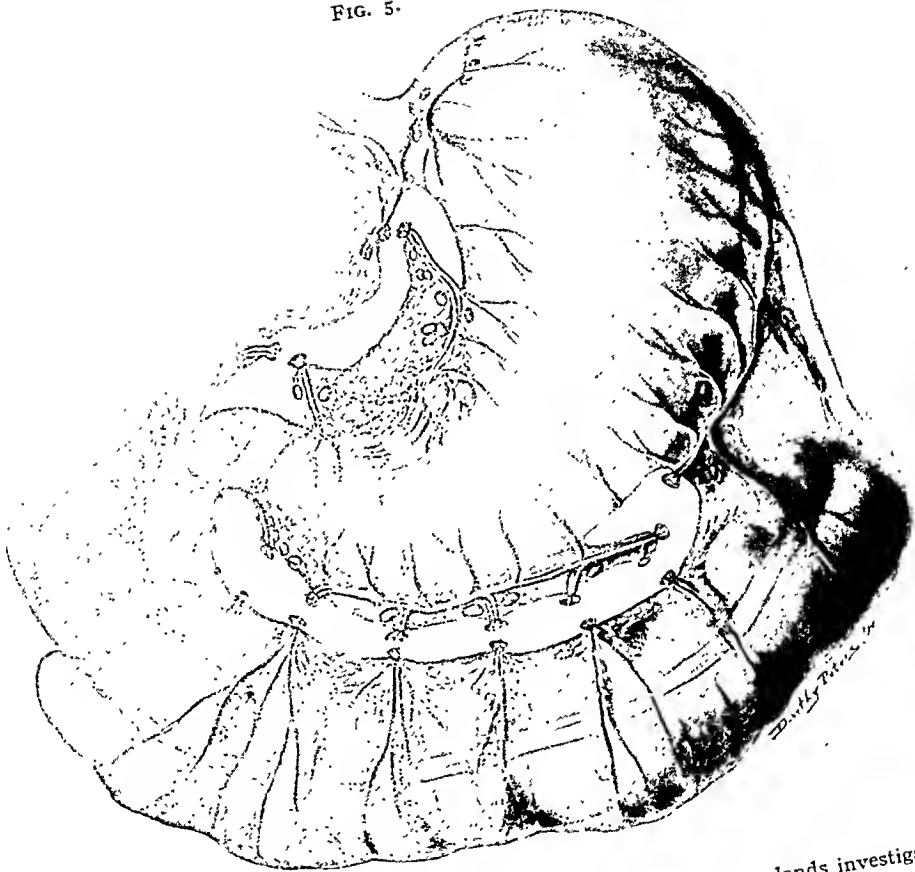
Case 25692. Microscopic section through the border of a simple gastric ulcer with a characteristic border and base. *a*, hypertrophic mucosa; *b*, dense scar tissue base.

FIG. 4.



Case 21555. Microscopic section through the carcinomatous border of a gastric ulcer. *a*, hypertrophic mucosa, cystic, and hypertrophic glands; *b*, invading glandular elements in the submucosa.

FIG. 5.



Portion of the stomach usually resected, showing the location of the glands investigated in this study. (Mayo.)

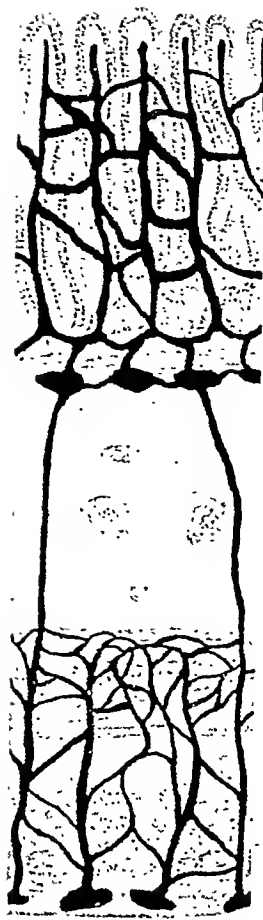
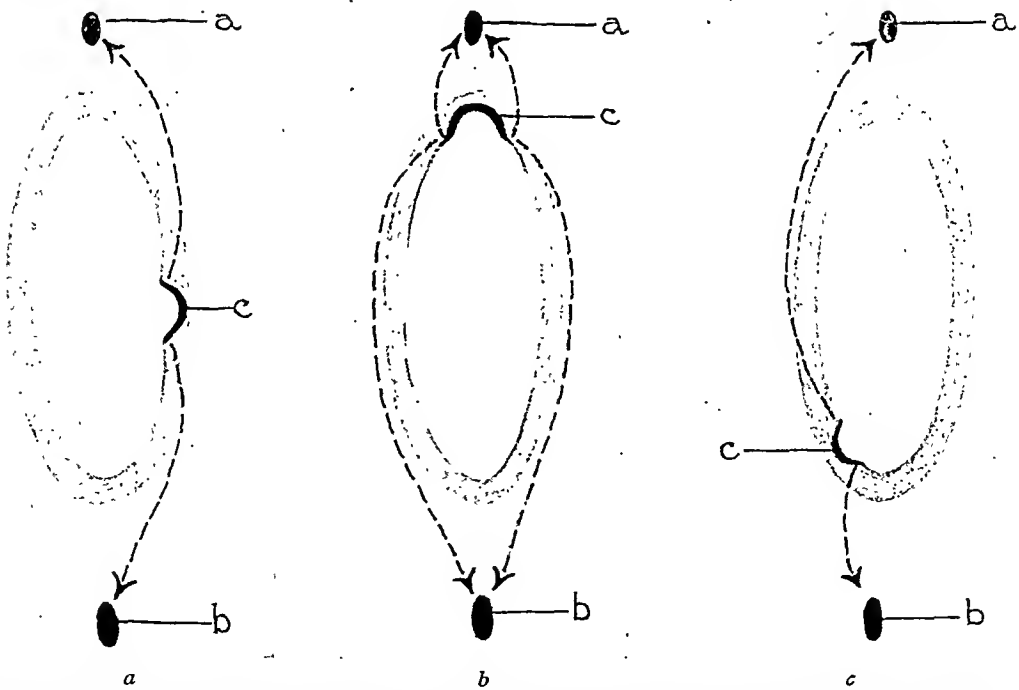


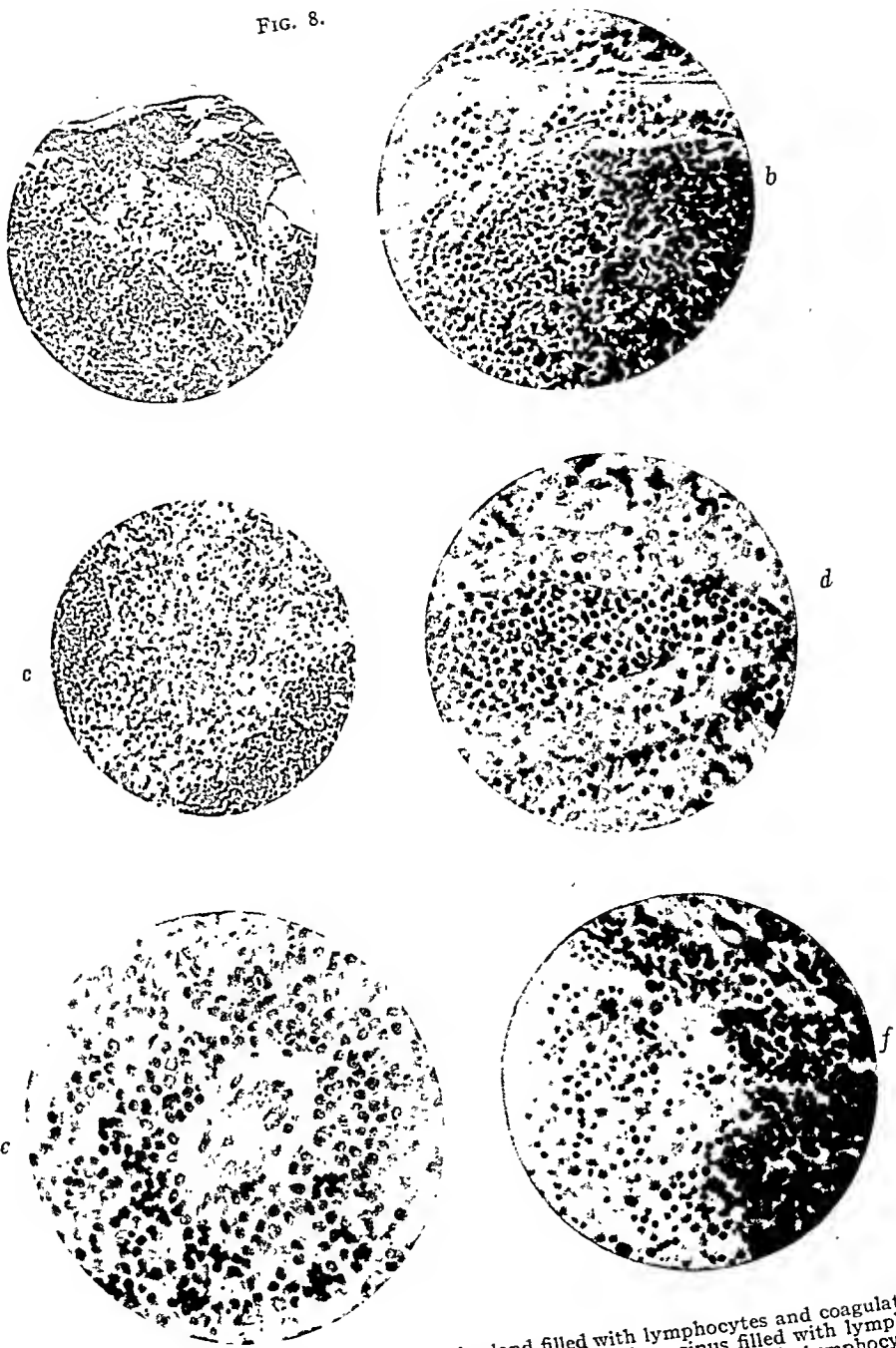
Diagram of wall of human stomach, showing injected lymphatic channels. (From Cuneo.)

FIG. 7.



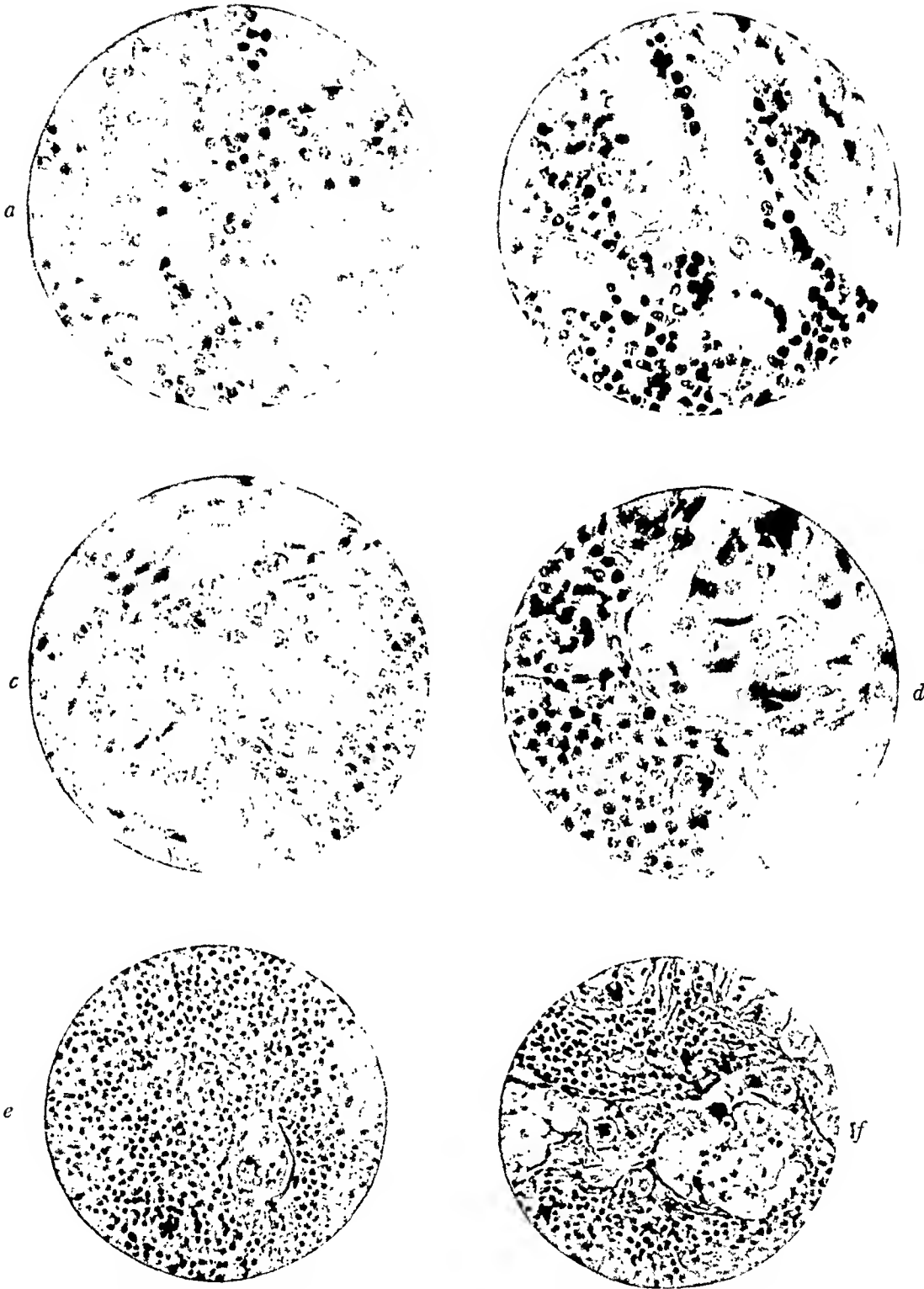
Diagrams of transverse sections of the wall of the stomach, showing hypothetical carcinomatous ulcers (c) and the directions of the resultant carcinomatous invasion of the lymphatic glands (a, b).

FIG. 8.



a, section showing a sinus of a lymphatic gland filled with lymphocytes and coagulated lymph; b, sinus in the deeper structure of a lymphatic gland; c, sinus filled with lymphocytes and exfoliated endothelial cells; d, sinuses containing coagulated lymph, lymphocytes (darkly stained), and endothelial cells (faintly stained); e, large endothelial cells lining a vessel which may be confused with groups of epithelial cells in carcinomatous invasion; f, sinus filled with lymphocytes, coagulated lymph, and large cells. The largest cell in the field is probably an epithelial cell.

FIG. 9.



a, lymph sinus containing large cells with clear pale nuclei. The lymphocytes are much darker. The exact denomination of these cells is extremely difficult. They are probably carcinoma cells in this case, although it is impossible to be absolutely certain. *b*, lymph sinus containing large pale cells, the diagnosis of which is uncertain. The nuclei when compared to those in Fig. 9, *c*, show marked similarity. *c*, carcinoma in lymph sinus. This picture should be compared to Fig. 9, *b*. *d*, carcinoma in lymph sinus. *e*, degenerating epithelial cells surrounded by lymphocytes, *f*, carcinoma. The epithelial cells are large, apparently degenerating, and contain leucocytes.

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and from 1 cm. to 5 cm. in depth. Such a series of specimens, showing carcinoma in many stages, allows one to consider the accompanying degrees of lymphatic reaction. After the condition of the glands was charted the specimens and charts divided themselves into three groups. Group I contained specimens in which no carcinomatous lymphatic glandular involvement was found; in Group II there was some glandular involvement, and in Group III all of the specimens showed carcinomatous glandular involvement.

Lesions which were 9 cm. in diameter and 3 cm. in depth occurred in Group I, a fact which demonstrates that carcinomatous cells in the stomach do not always enter the lymphatic glands with the same rapidity nor at any apparent definite stage in their development.

Small ulcerations—2 cm. in diameter and 2 cm. in depth—with carcinomatous borders occasionally showed complete glandular involvement. From these figures alone it may be seen that one should not judge the condition of the lymphatics by the size of the primary lesion. There is apparently no direct relation between the size of the primary lesion and the glandular involvement. Large tumors exist without carcinomatous glandular involvement and small tumors exist with extensive carcinomatous glandular involvement. The surgeon should, therefore, be guided by the microscopic examination of regional glands. Macroscopic diagnosis, as pointed out by Lengemann,¹ Renner,² Cuneo,³ and others, has little value because glands which are grossly inflammatory often contain microscopic carcinomatous involvement.

Resected gastric specimens contained from 1 to 15 lymphatic glands,† in the lesser curvature and from 1 to 13 in the greater curvature. The average in the lesser curvature was 2.9 and the greater curvature 5.1. They varied in size from 2 mm. to 2 cm. in their long diameters and from 2 mm. to 1.5 cm. in their short diameters. Their size had no appar-

† Specimens which were removed several years ago when no attempt was made to remove all of the lymphatic glands in cases which were resected palliatively show usually a small number of glands. These cases reduce the general average in this paper.

ent relation to the size of the lesion, duration of dyspepsia, duration of acute symptoms, age, nor sex.

The 200 specimens examined contained 1404 lymphatic glands. Fifty-two per cent. of these were carcinomatous. This figure agrees almost exactly with the percentage reported by Lengemann,¹ who found 42 per cent. of 302 lymphatic glands involved, and by Renner,² who reports 50 per cent. of 78 lymphatic glands of the subpyloric group carcinomatous.

Large lymphatic glands may be inflammatory and small glands may be carcinomatous (see charts). The color, shape, size, and consistency of a lymphatic gland are not varied by the presence of one or two groups of carcinomatous cells in a sinus. Gross diagnoses are of value only in extensive involvement.

Inflammatory lymphatic hyperplasia (Figs. 8 and 9) which was found in many stages of its development in non-carcinomatous (Fig. 8) and carcinomatous (Fig. 9) glands is most important to the surgical pathologist, whose duty it is to differentiate lymphocytoblastic cells, endothelial cells, and large mononuclear lymphocytes in a hyperplastic lymphatic gland from isolated epithelial cells in the lymphatic sinuses. Differentiation for operative purposes should not be attempted by a pathologist of meagre experience. Groups of epithelial cells (Fig. 9) in the lymphatic glands should be the criterion of carcinomatous involvement. Large cells are often seen in the sinuses (Fig. 8, *d*, and *f*, and Fig. 9, *a* and *b*); some are exfoliated endothelial cells, others are doubtless macrocytes. One cannot always say that they are not epithelial cells (Fig. 9, *c*, *d*, *e* and *f*). In a lymphatic gland which is extremely hyperplastic the germinal centres present cells (lymphocytoblastic) which are variable in size and shape; these are so irregular that it is practically impossible to distinguish them from the irregular epithelial cells of carcinoma.

The cells of carcinoma are found in the peripheral or subcapsular sinuses early in lymphatic involvement, as has been previously noted by Billroth,⁹ Bozzolo,¹⁰ Rindfleisch,¹¹ Orth,¹² Zender,¹³ Petrick,¹⁴ and Cuneo.³ They may be single or in groups (Fig. 9). They may invade the tissues surrounding the sinuses. The gland may become filled with dense

connective tissue which may also become invaded. The cells occasionally penetrate the glandular capsule and invade the surrounding fat.

A detailed history of each of 200 cases would occupy more space than was intended for this paper. It must, therefore, be sufficient to briefly state their positive and negative relation to glandular involvement.

The average ages in Groups I, II, and III, are respectively 50.8 years, 51.7 years, and 46 years, which show no apparent relation between the amount of lymphatic involvement and the age of the patient when seen at operation. In the third group (extensive involvement), the average age is five years younger than the second group (partial involvement), which suggests a more rapid progress in younger individuals. The difference, however, is not sufficiently great to allow such conclusions. The extreme ages at which carcinoma of the stomach were found in this series are 30 and 83 years, a fact which adds another point to free our minds of the old clinical adage that carcinoma is a disease of middle life.

The history of gastric disturbances of a mild or intermittent nature, which have extended over a long period, may have some etiological relation to ulceration of the gastric mucosa. This feature was studied in the three groups without finding results of positive value. The duration of dyspepsia extended over average periods of 8.5 years, 8 + years and 8 + years in the three groups.

Seventy-three per cent. of all cases were in males and 27 per cent. in females, a ratio which remains practically the same in the three groups—a fact which demonstrates that sex plays no apparent rôle in influencing the amount of involvement.

Acute gastric disturbances existed in Groups I, II, and III respectively 17.2 months, 12.5 months, and 17.4 months.

A consideration of clinical facts carries with it many difficulties. Loss of weight, for example, may be due to dietary starvation, gastric secretory inactivity, gastric motor insufficiency, pyloric obstruction, or toxæmia. Whether or not one or more of these be the cause of the loss of weight in these cases, the fact remains that in Group I the average loss of

weight was 25 pounds; Group II, 28.4 pounds; Group III, 42.5 pounds. In the absence of pyloric obstruction the amount of reduction in weight may be an approximate clinical index of glandular involvement.

Another point of interest to the clinician and surgeon from a prognostic stand-point is the immediate post-operative hospital mortality in reference to the amount of glandular involvement at operation. The groups presented the following figures: Group I, 7.6 per cent.; Group II, 11.6 per cent.; Group III, 18.7 per cent. The parallel increase between the amount of glandular involvement and the hospital mortality may be indicative only of reduction of general resistance or local tissue reparative reduction in extensive carcinoma.

The subsequent mortality also varied in the different groups. The percentage of the cases which were alive one, two and three years after resection was higher in the cases without glandular involvement. Thirty-eight and four-tenths per cent. of all the cases of which some knowledge was obtained were dead.

The findings of this investigation have positive and negative value. They are, however, of greatest value in supplying the macroscopic and gross microscopic findings in a large series of specimens examined under fresh conditions at operation and confirmed by fixed tissue.

The negative conclusions may be summarized as follows:

1. The size of regional lymphatic glands bears no apparent relation to the size of the primary lesion in the stomach.
2. The size of a lymphatic gland is no criterion of the presence or absence of carcinoma.
3. Gross diagnoses of lymphatic glands are of no value except in advanced carcinoma of the glands.
4. The duration of symptoms bears no apparent relation to the size and extent of involvement in the lymphatic glands.
5. The average age at operation and sex bear no direct relation to the glandular involvement.

The positive conclusions may be summarized as follows:

1. The average loss of weight increases with the increase in extent of glandular involvement.

2. The immediate hospital post-operative mortality is in direct proportion to the amount of glandular involvement.

3. The subsequent mortality is in direct proportion to the amount of glandular involvement.

4. Carcinomatous glandular involvement is very often microscopic.

5. The surgeon who desires to treat early carcinoma must depend upon the microscope in the hands of an experienced pathologist for early carcinomatous lymphatic involvement.

6. The diagnosis of early carcinomatous involvement requires extensive experience in the study of the so-called pre-carcinomatous reaction of lymphatic glands.

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GROUP I.

Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.	Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.
16806	5	4	1	0	0	31739	3	0	3	0	0
16884	3	2	1	0	0	32018	6	0	0	0	0
17139	1	1	0	0	0	32273	10	1	9	0	0
17424	1	1	0	0	0	33109	4	0	4	0	0
17586	2	0	2	0	0	33226	10	4	6	0	0
17835	3	0	3	0	0	33255	7	1	6	0	0
18271	1	0	1	0	0	33363	11	2	9	0	0
20367	5	0	5	0	0	33621	9	2	7	0	0
20468	5	2	3	0	0	35572	3	3	0	0	0
20887	4	1	3	0	0	35590	7	2	5	0	0
21965	3	2	1	0	0	35970	3	0	3	0	0
22289	4	2	2	0	0	36489	7	2	5	0	0
22314	5	1	4	0	0	36649	10	2	8	0	0
22925	2	2	0	0	0	37070	3	3	0	0	0
23374	4	4	0	0	0	37080	6	1	5	0	0
23651	11	1	10	0	0	37265	6	2	4	0	0
24277	4	1	3	0	0	37340	8	2	1	0	0
24712	4	0	4	0	0	37392	3	2	1	0	0
24909	14	5	9	0	0	37873	3	2	1	0	0
25449	6	2	4	0	0	40013	9	3	6	0	0
26273	10	4	6	0	0	40930	6	2	4	0	0
27208	6	1	5	0	0	41081	1	0	1	0	0
27365	4	2	2	0	0	41223	7	1	6	0	0
27831	4	0	4	0	0	41511	5	5	0	0	0
28004	1	1	0	0	0	41804	3	0	3	0	0
28105	6	2	4	0	0	41966	6	1	8	0	0
28294	8	0	8	0	0	42143	9	1	1	0	0
28358	13	2	11	0	0	42151	3	2	1	0	0
29322	8	2	6	0	0	43400	7	3	4	0	0
30060	7	3	4	0	0	43698	6	2	4	0	0
30363	9	2	7	0	0	Spec. C	5	0	5	0	0
30809	6	0	6	0	0	26751	6	4	2	0	0
30824	6	4	2	0	0						

GROUP I.—DIAGRAMS OF SPECIMENS WITH NO CARCINOMATOUS GLANDULAR INVOLVEMENT. INFLAMMATORY GLANDS ARE WHITE.

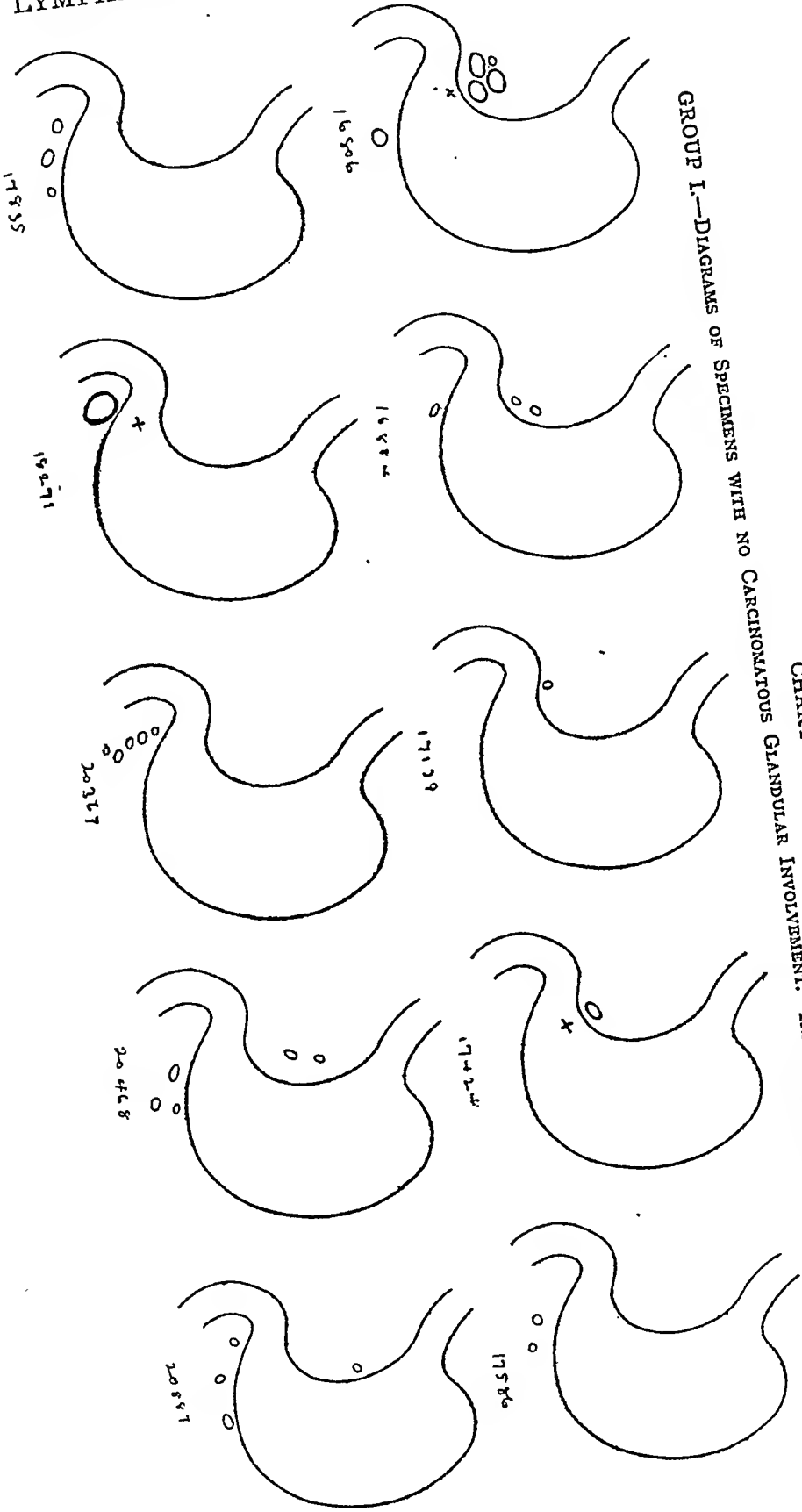


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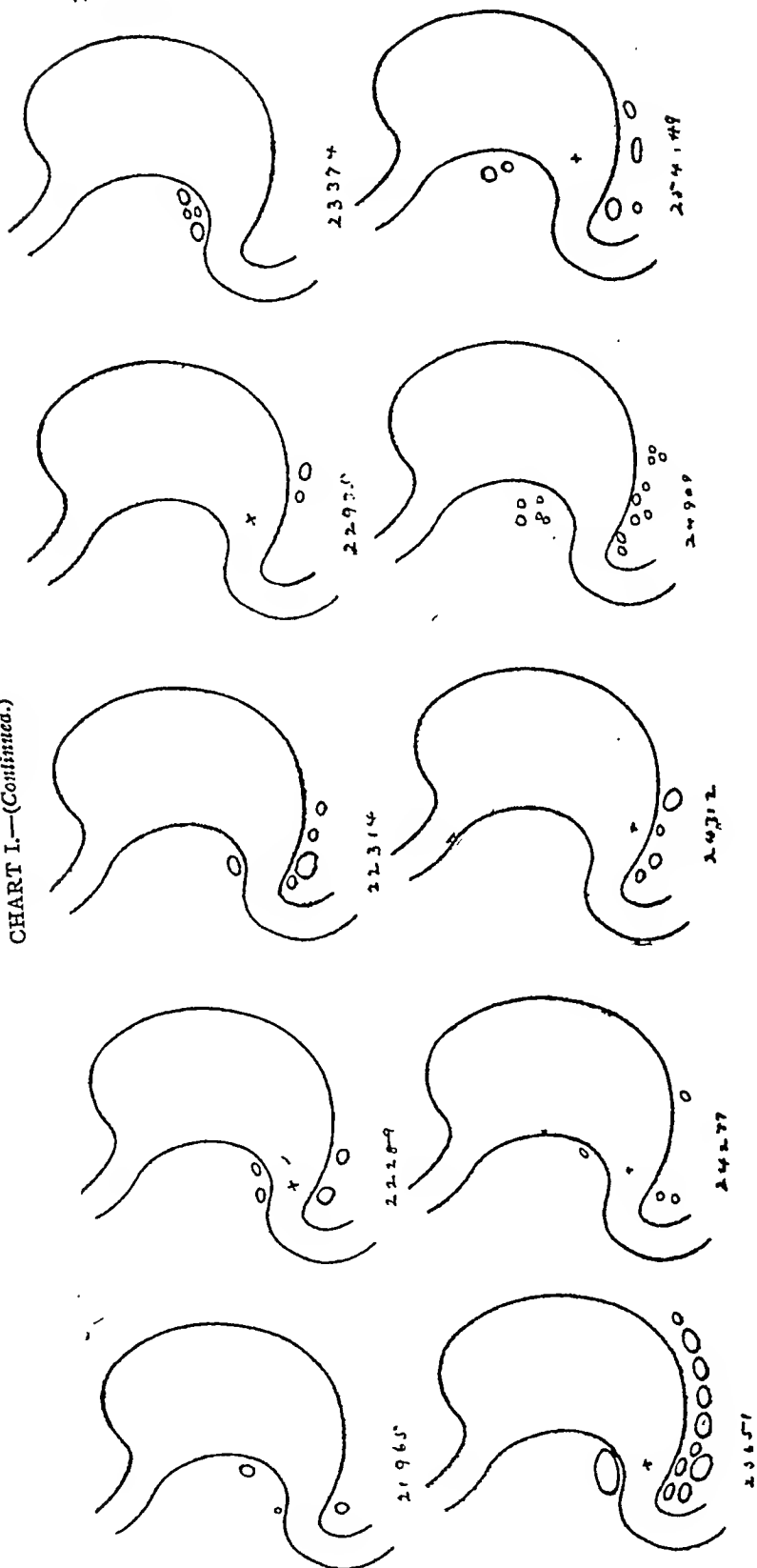


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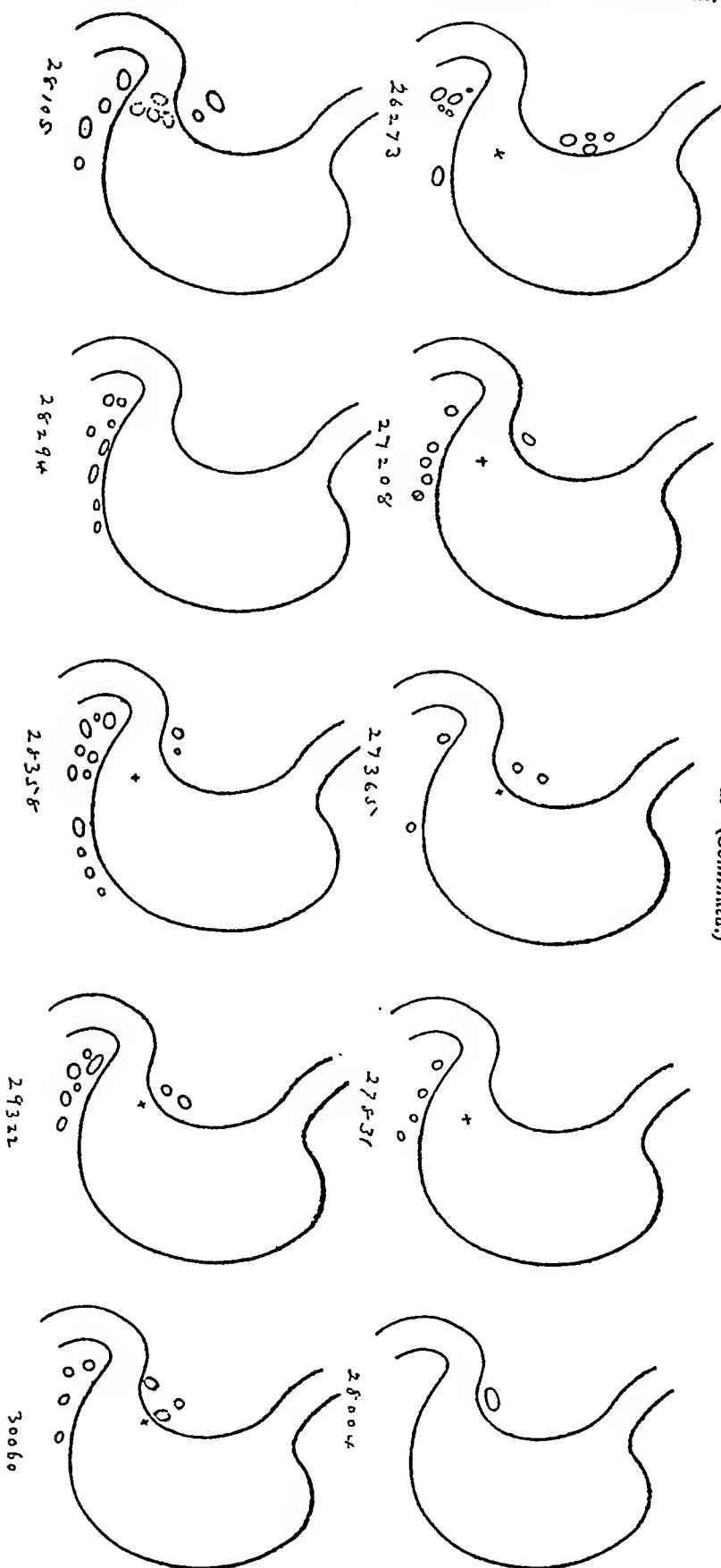
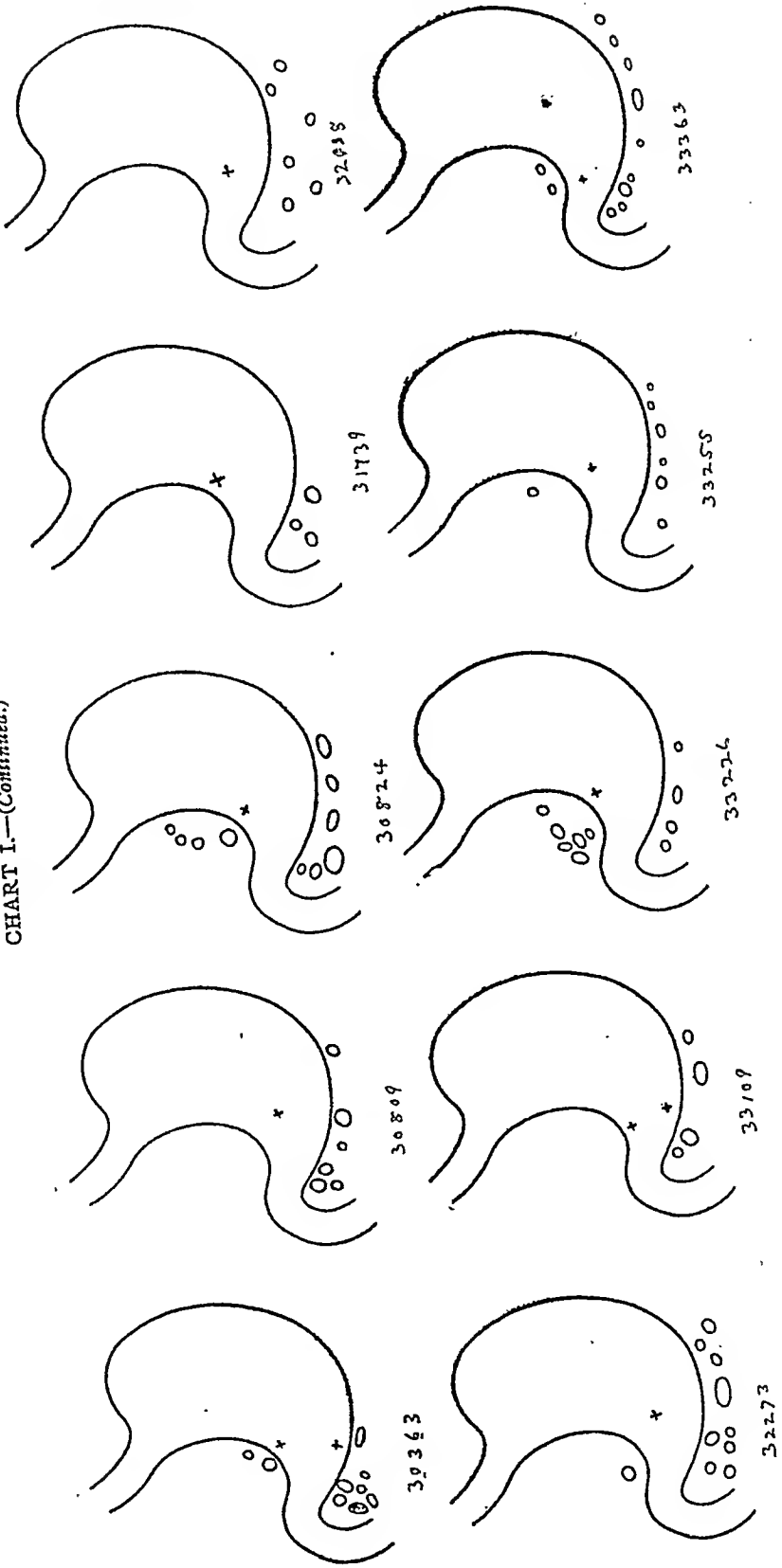


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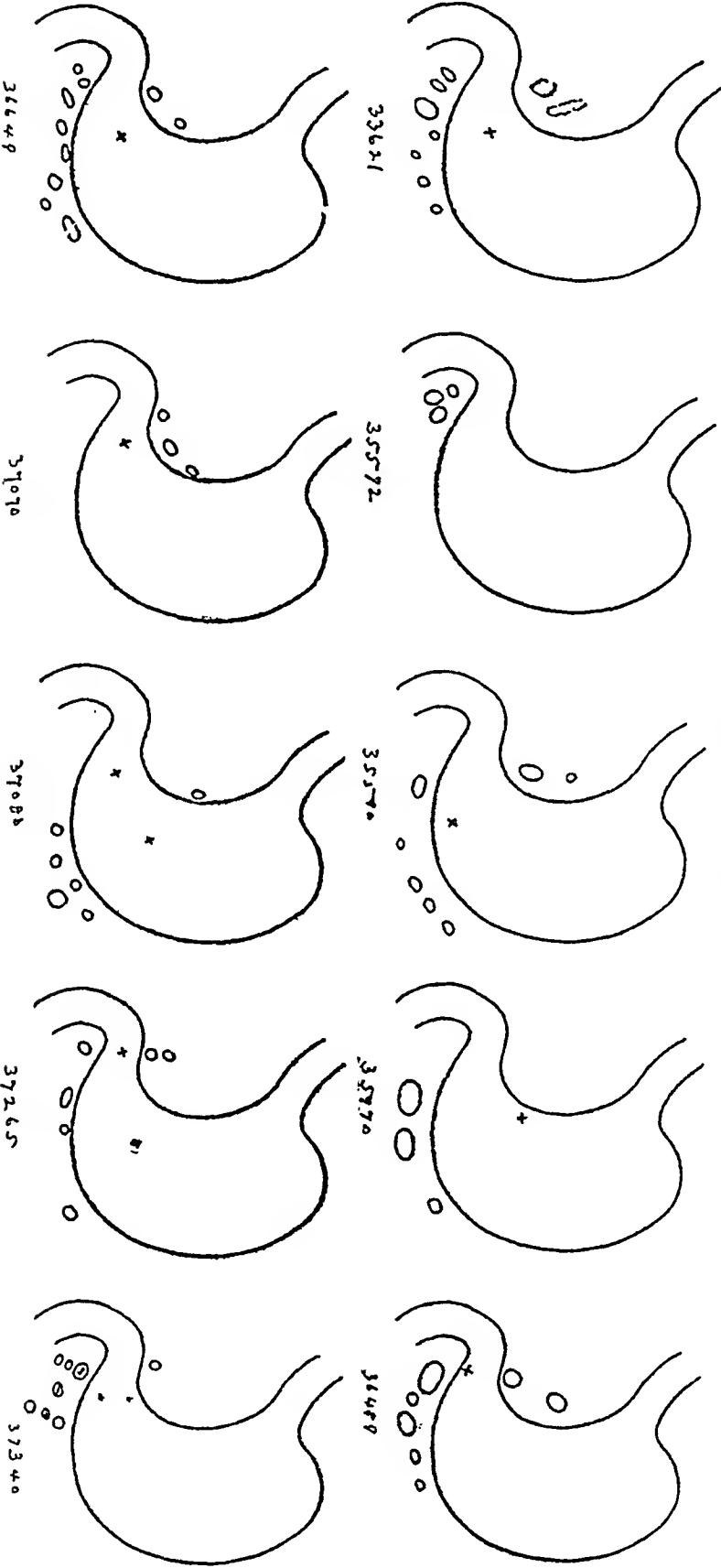
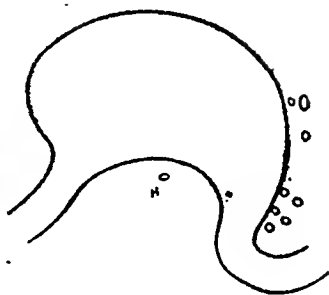


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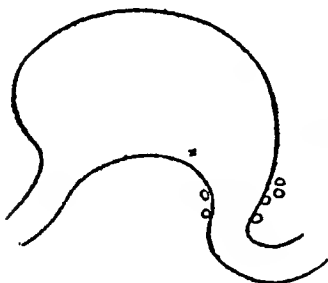
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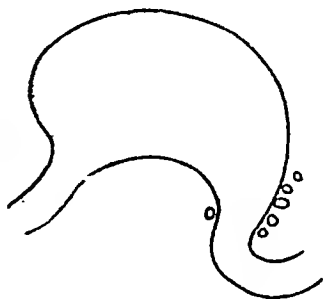
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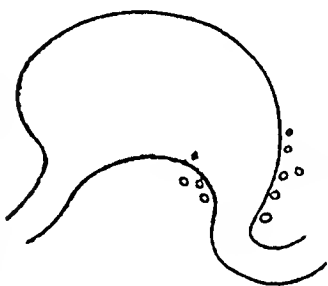
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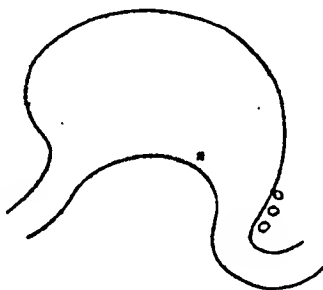
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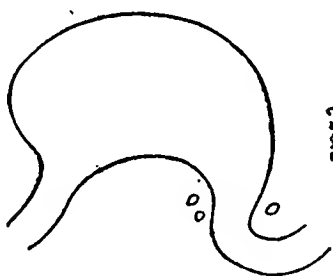
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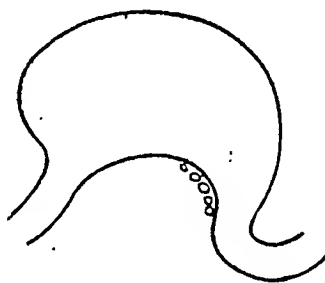
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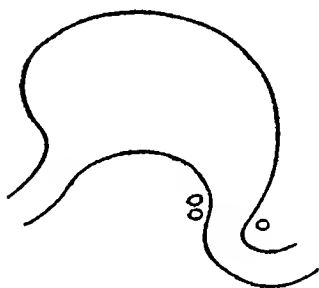
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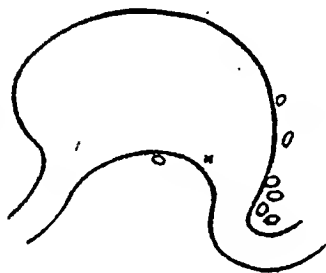
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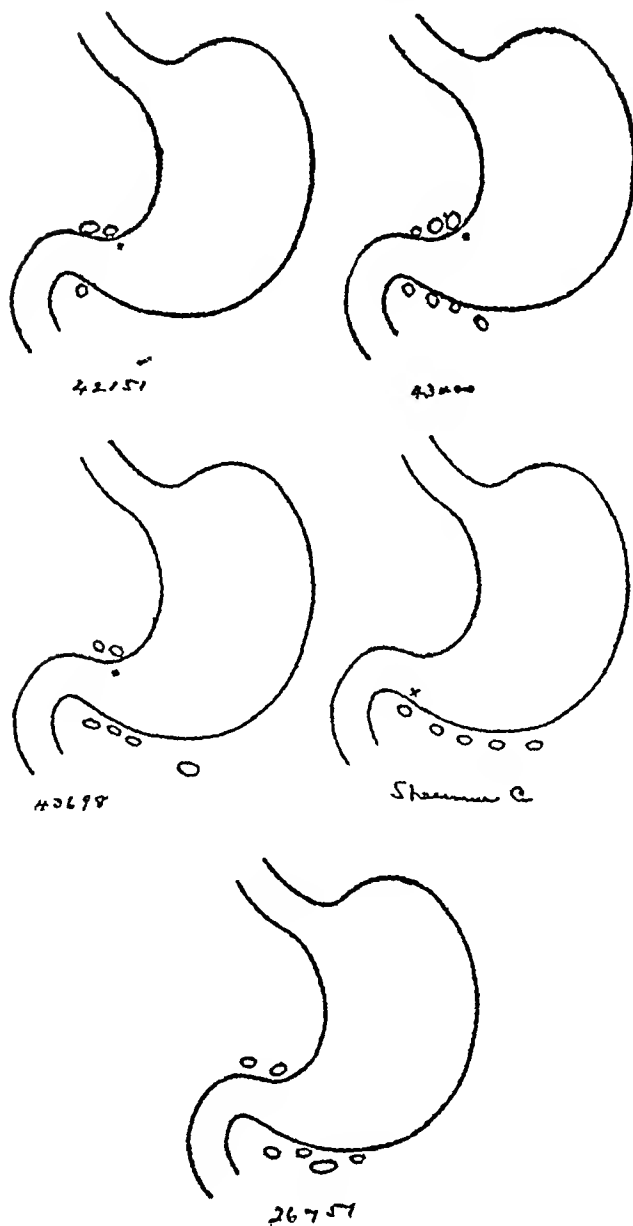


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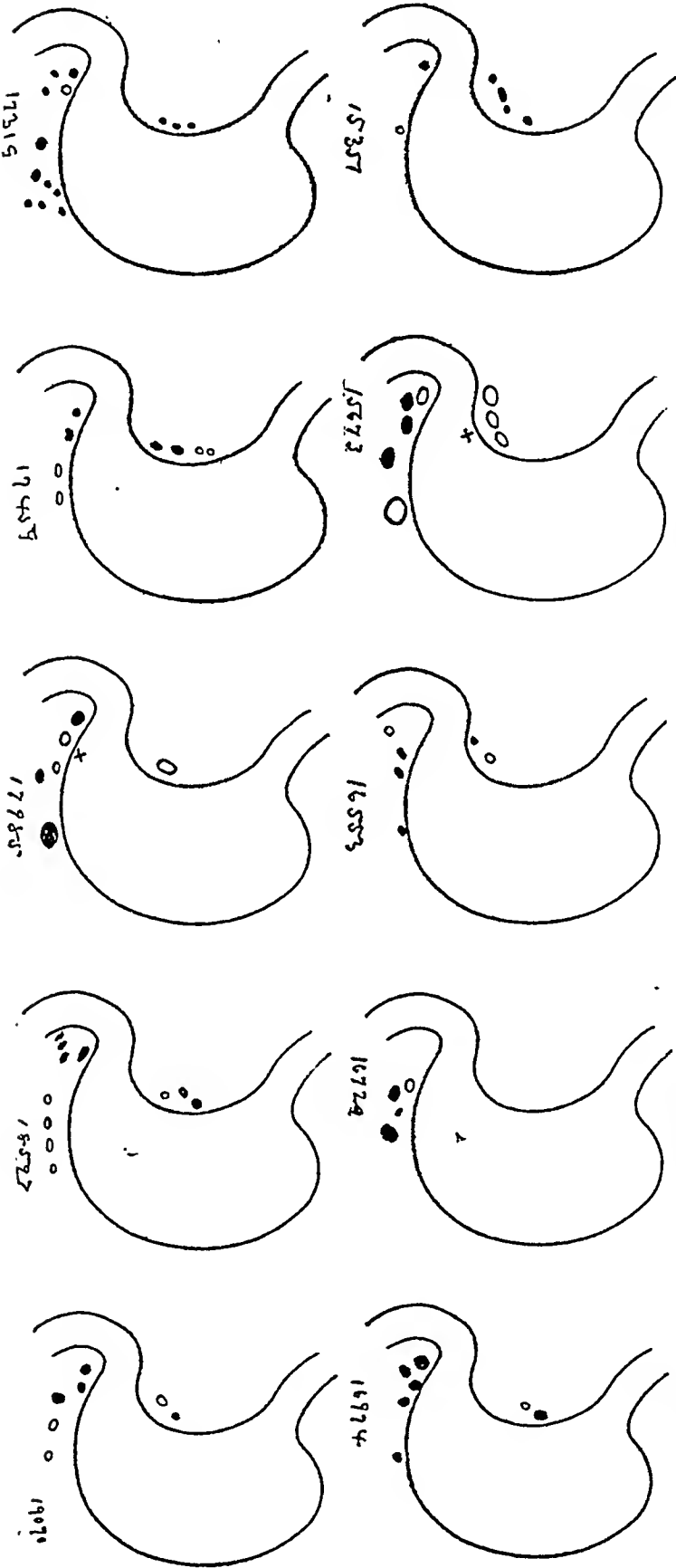


GROUP II.

Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.	Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.
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15673	8	3	5	0	3	31450	11	3	8	0	2
16553	6	2	4	0	2	31451	10	2	8	1	0
16729	4	0	4	0	2	31746	4	4	0	0	0
16974	7	2	5	1	5	31861	12	4	8	4	4
17319	14	3	11	3	10	31951	8	1	7	0	1
17459	8	4	4	2	2	31969	11	3	8	3	5
17985	6	1	5	0	3	32076	12	2	10	2	2
18597	11	3	8	2	4	32356	18	7	11	6	9
19070	7	2	5	1	2	32359	9	3	6	0	4
19322	8	3	5	1	3	32393	14	1	13	1	6
19376	4	2	2	1	1	32576	13	7	6	2	0
19559	4	1	3	1	2	32367	9	3	6	3	3
19604	14	6	8	2	6	33213	7	1	6	1	3
19832	2	0	2	0	1	33675	11	6	5	0	1
20442	9	4	5	2	4	33956	8	2	6	1	0
20447	9	4	5	2	4	33982	10	3	7	3	3
20623	10	3	7	2	3	33359	10	4	6	4	2
21659	4	1	3	0	1	34431	5	5	0	3	0
21803	13	4	9	3	8	34511	6	4	2	1	1
22001	6	3	3	1	0	35211	11	6	5	0	5
22047	8	1	7	1	5	35389	5	5	0	1	0
22309	10	1	9	0	6	35856	2	1	1	0	1
22973	8	1	7	0	2	36484	11	4	7	3	1
23406	8	4	4	0	1	37193	10	5	5	4	2
23612	6	0	6	0	1	37237	16	6	10	2	7
24382	8	0	8	0	3	37674	8	3	5	1	0
24527	16	3	13	0	4	37876	3	0	3	0	2
24555	9	3	6	1	0	38073	10	2	8	1	2
25550	5	2	3	2	1	38150	11	0	11	0	7
25563	13	2	11	0	8	38368	4	0	4	0	1
26043	9	3	6	2	4	38550	6	0	6	0	5
26541	5	1	4	1	3	39944	13	4	9	2	1
26743	8	3	5	3	4	40742	5	0	5	0	2
26965	8	5	3	4	2	40840	3	0	3	0	1
27209	6	3	3	3	2	41251	7	0	7	0	3
27370	5	0	5	0	2	41342	16	4	12	1	3
27559	6	2	4	1	2	42325	5	1	3	1	0
27734	5	2	3	2	0	42532	3	1	3	1	1
27898	7	3	4	3	3	42990	4	8	0	3	0
28363	9	4	5	2	0	43068	8	8	0	2	1
28189	11	3	8	1	4	43086	5	2	3	0	2
28579	10	5	5	4	4	43180	4	0	4	1	8
28880	13	5	8	5	6	43542	10	1	9	5	3
28936	13	3	10	1	7	43758	10	5	5	1	0
29239	11	5	6	5	2	43894	8	2	6	2	5
29799	8	1	7	0	4	44070	12	2	10	0	1
29904	8	1	7	0	2	44064	5	1	4	0	7
30316	11	1	10	1	4	Spec. A	13	6	7	2	1
30464	6	1	5	0	1	Spec. D	9	0	9	0	1
31140	19	5	14	1	2	42585	4	4	4	4	2
31297	11	3	8	0	3	& mass mass 4 mass ca. 2					

CHART II.

GROUP II.—DIAGRAMS OF SPECIMENS WITH SOME CARCINOMATOUS GLANDULAR INVOLVEMENT. CARCINOMATOUS GLANDS ARE SOLID BLACK.



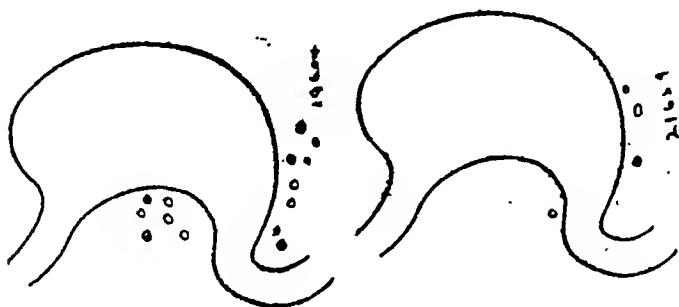
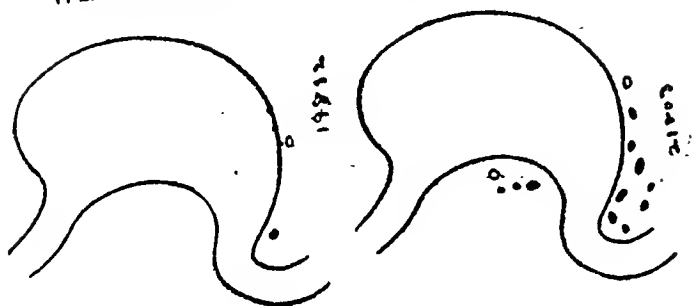


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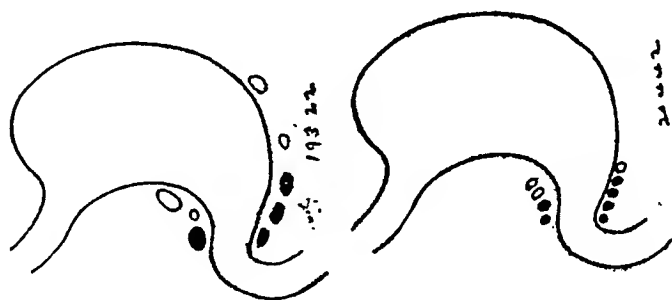
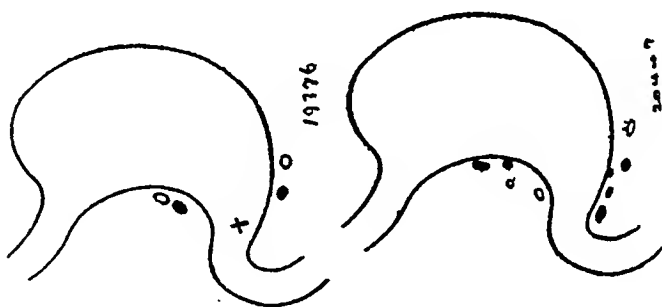
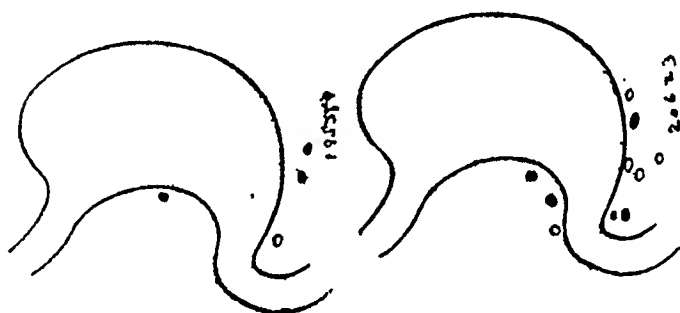
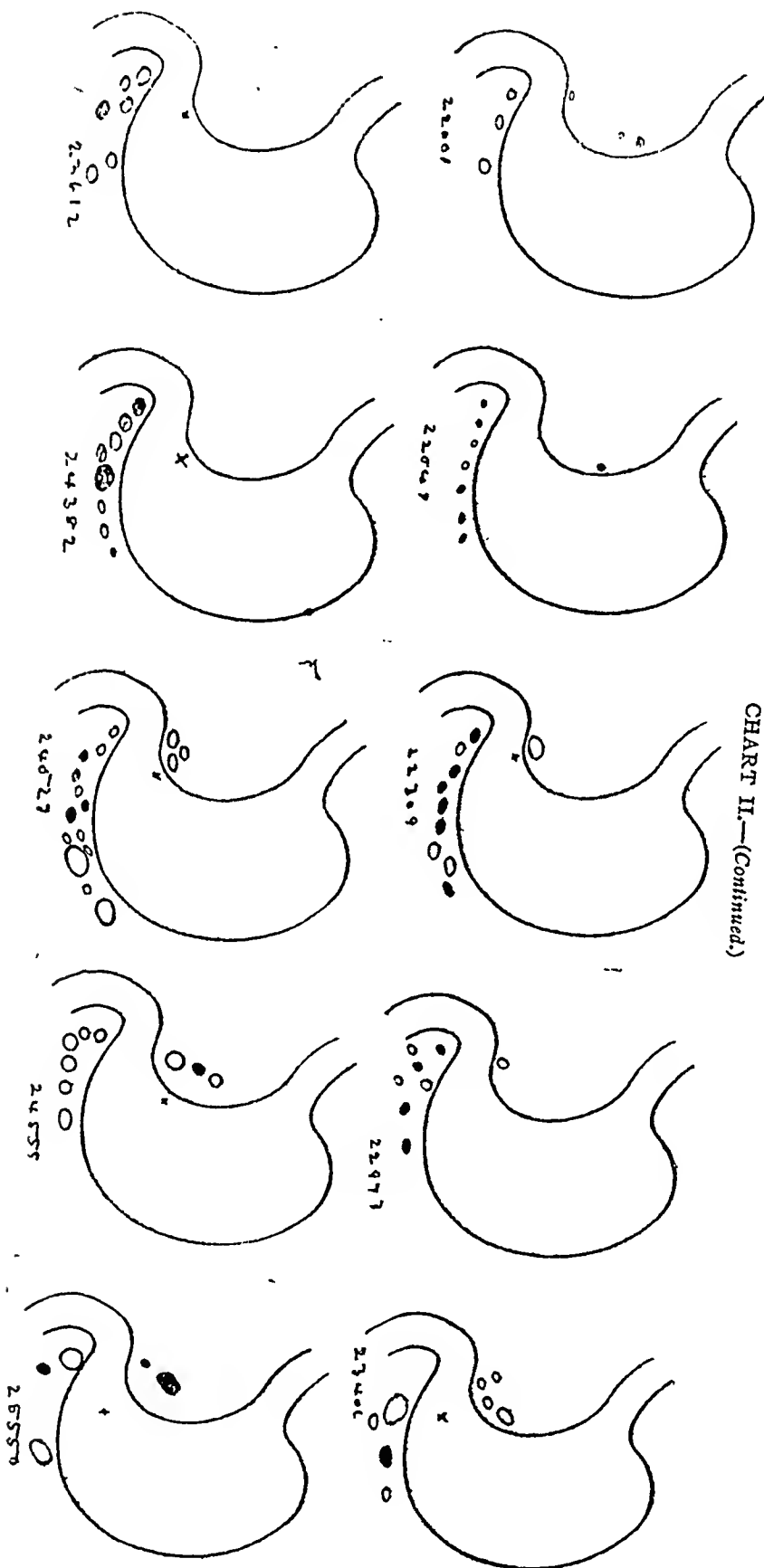


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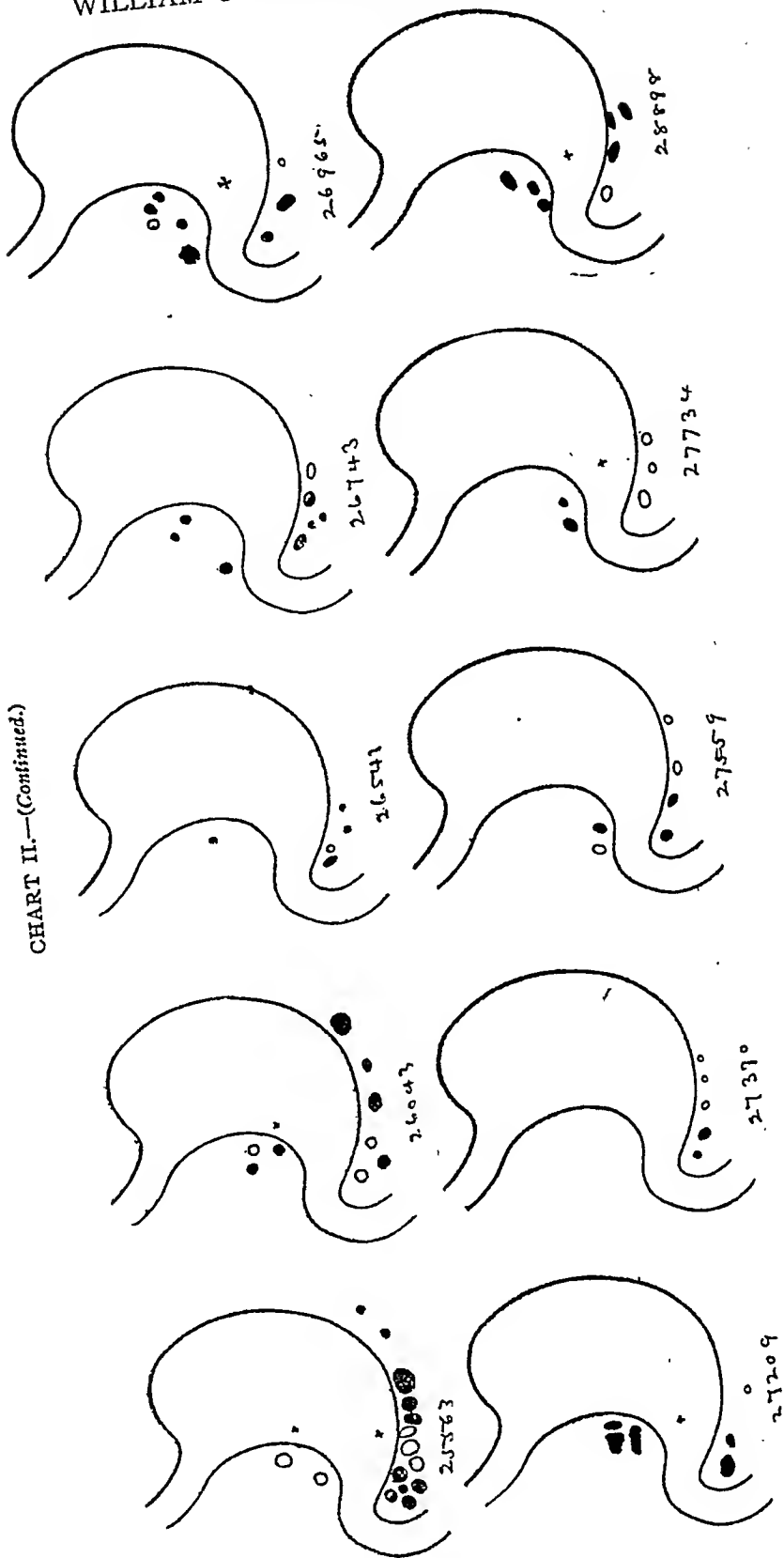
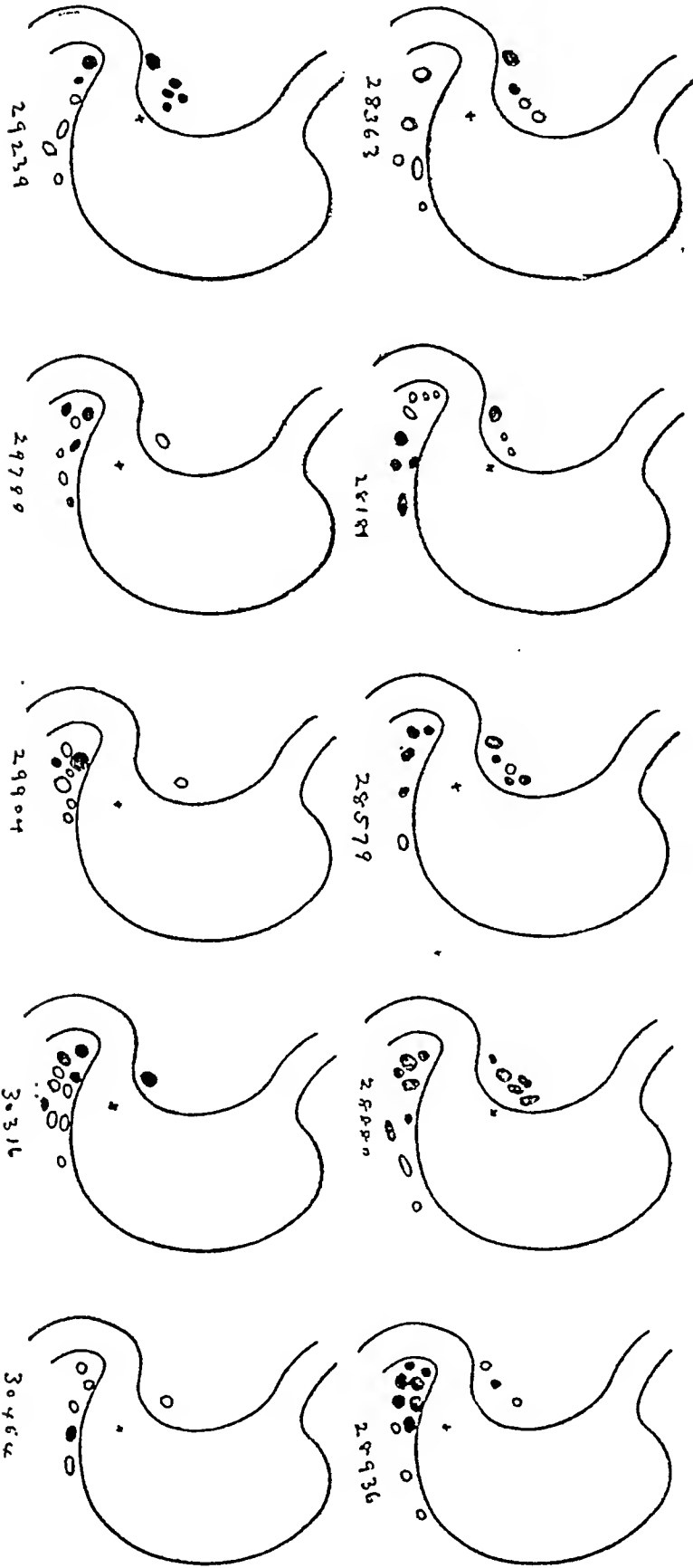


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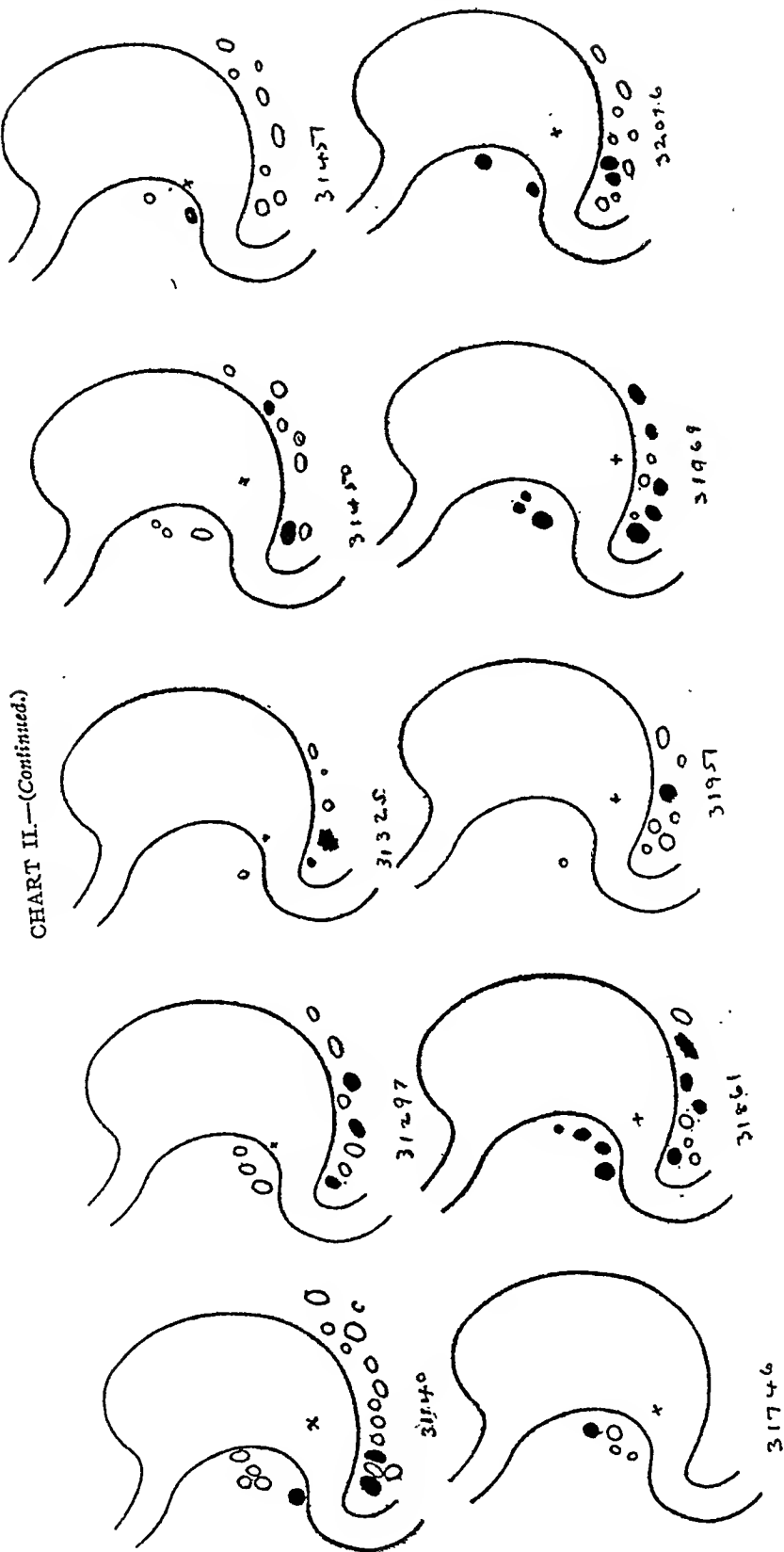


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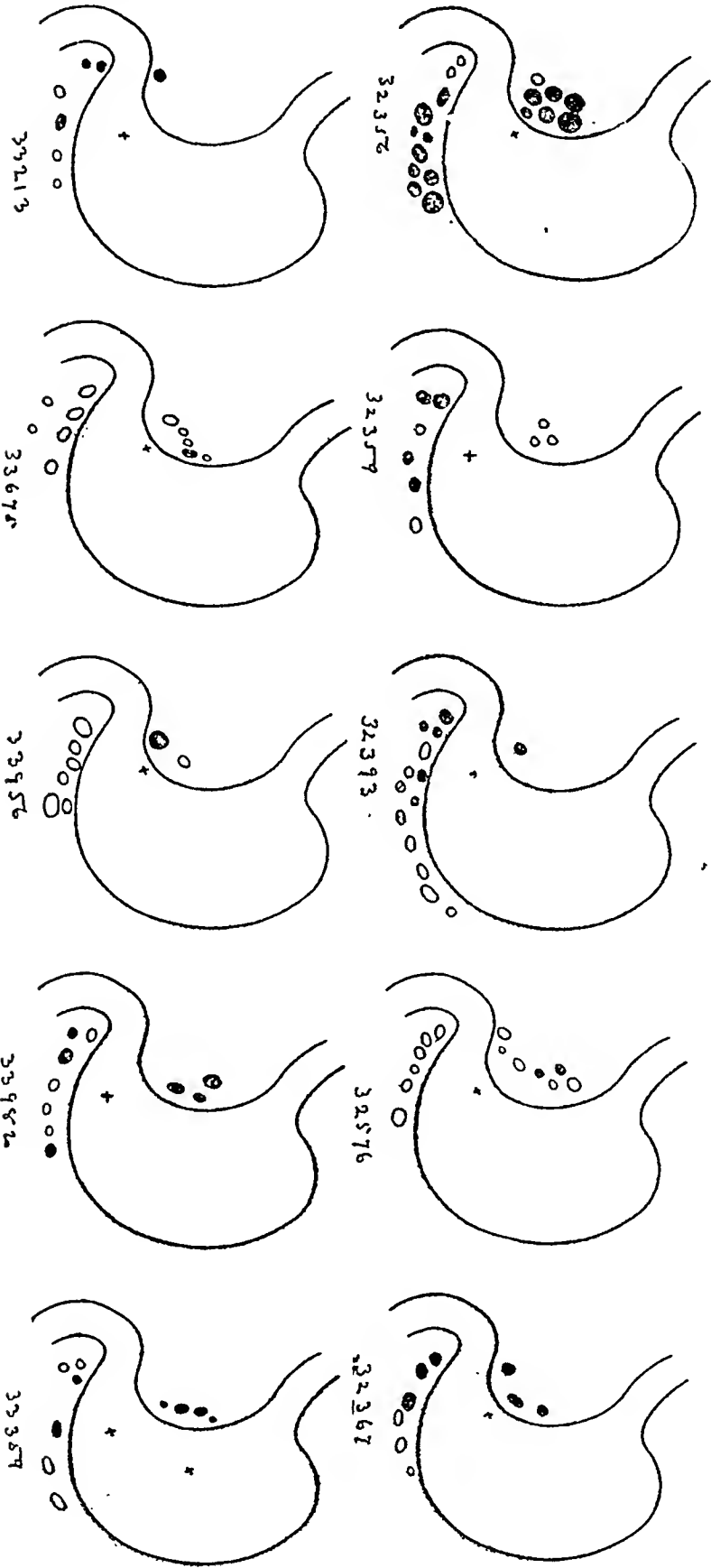


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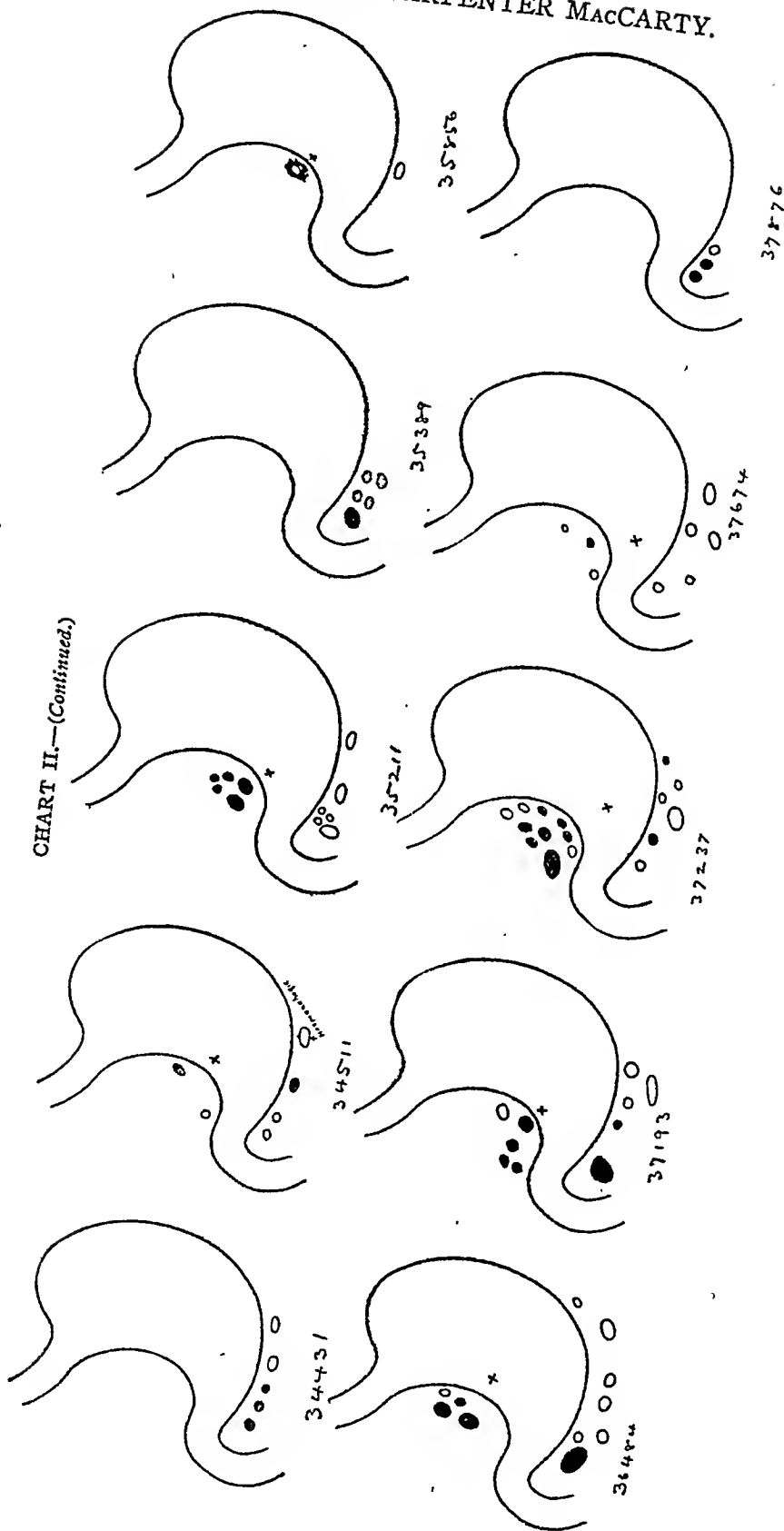
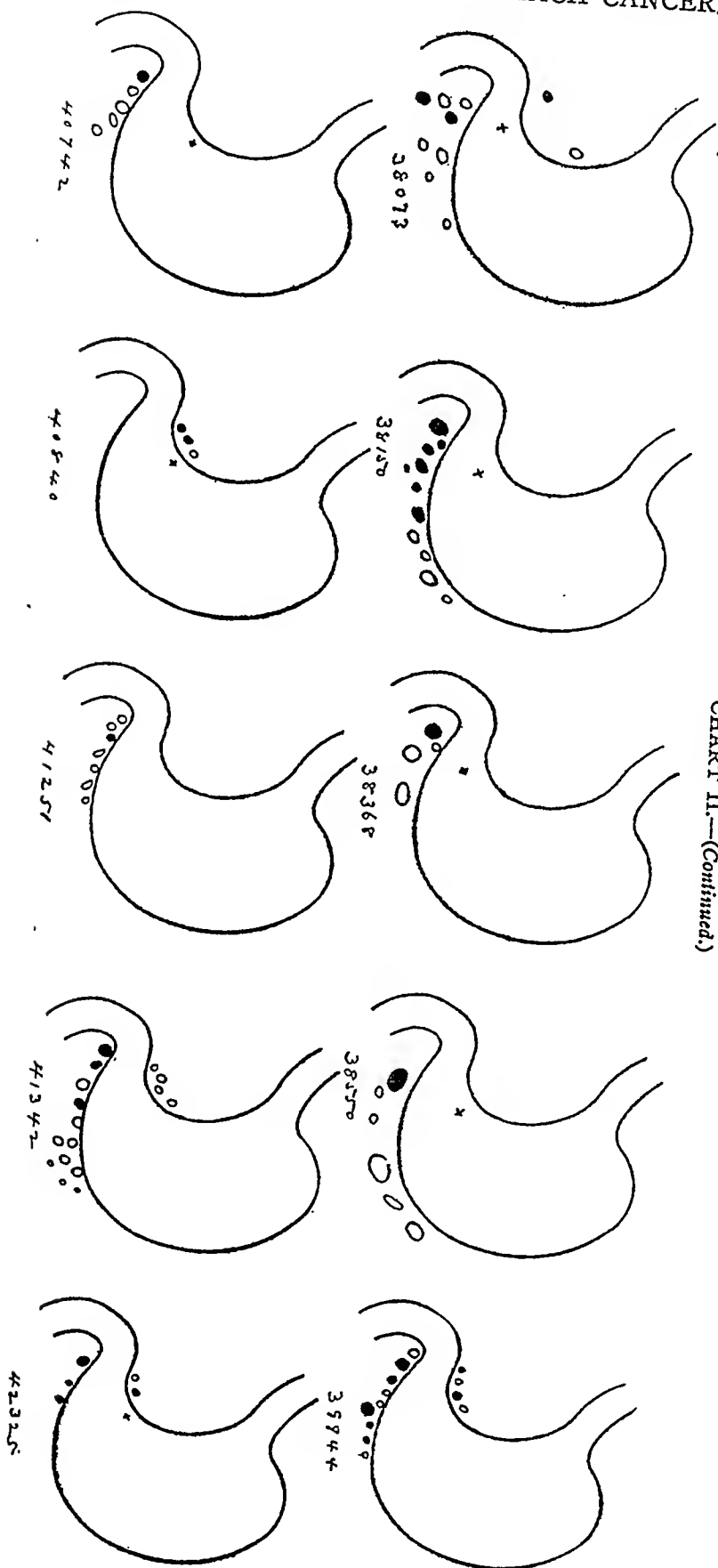


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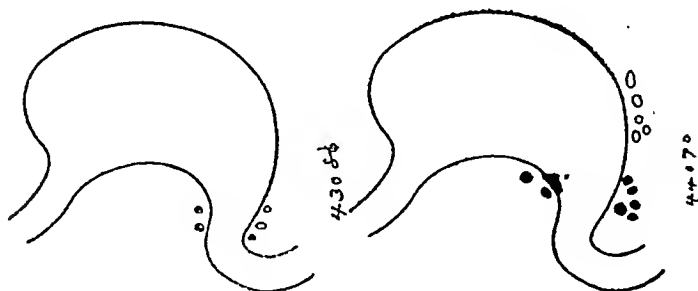
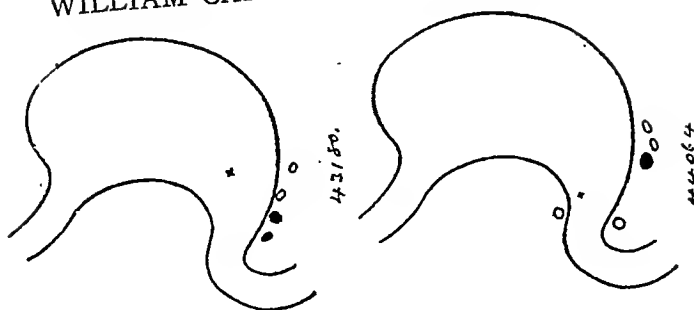


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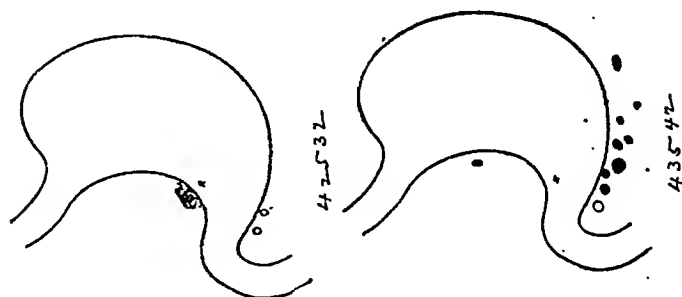
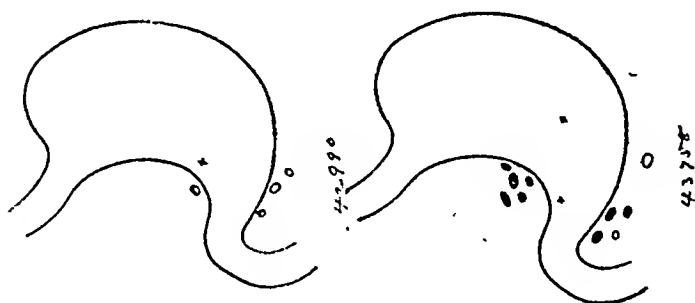
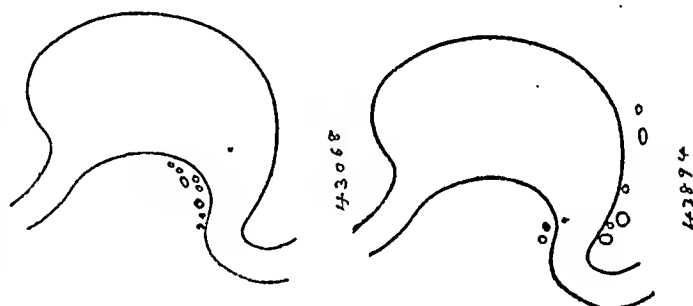
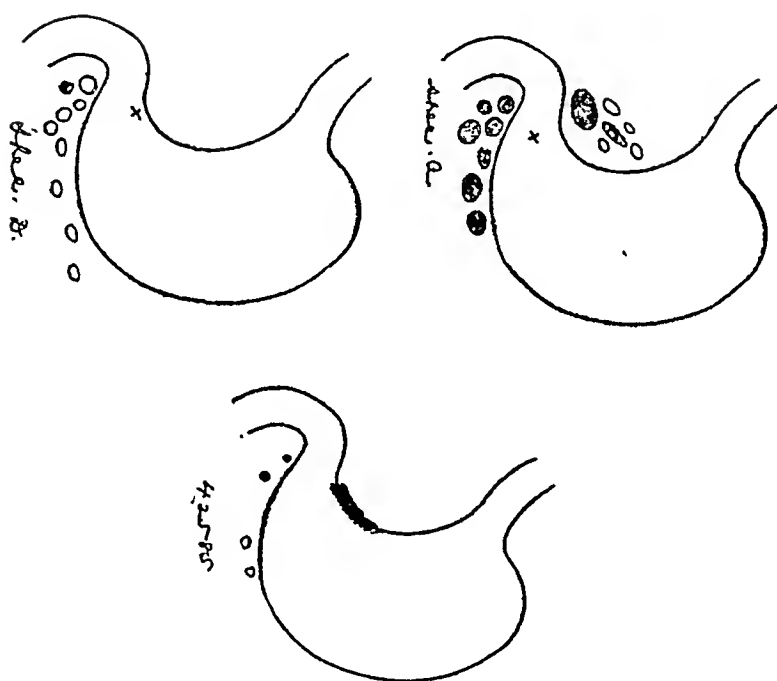


CHART II.—(Continued.)



GROUP III.

Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.	Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.
14849	7	4	3	4	3	18466	9	3	6	3	6
14857	11	4	7	4	7	18468	5	2	3	2	3
14897	1	1	0	1	0	18728	4	0	4	0	4
15357	5	3	2	3	2	19574	15	5	10	5	10
15681	4	3	1	3	1	21873	3	0	3	0	3
15775	8	6	2	6	2	21882	3	3	0	3	0
16142	3	1	2	1	2	23025	5	0	5	0	5
16525	13	3	10	3	10	23654	4	1	3	1	3
16636	9	2	7	2	7	27898	3	1	2	1	2
16651	4	2	2	2	2	29402	8	0	8	0	8
16955	2	2	0	2	0	31855	6	1	5	1	5
17377	2	1	1	1	1	33445	21	15	6	15	6
17407	Esophageal glands.					33779	5	3	2	3	2
17715	8	4	4	4	4	40605	1	1	0	1	0
18088	5	2	3	2	3	41070	6	0	6	0	6
18430	5	3	2	3	2	43393	1	1	0	1	0

CHART III.

GROUP III.—DIAGRAMS OF SPECIMENS WITH TOTAL CARCINOMATOUS GLANDULAR INVOLVEMENT. CARCINOMATOUS GLANDS ARE SOLID BLACK.

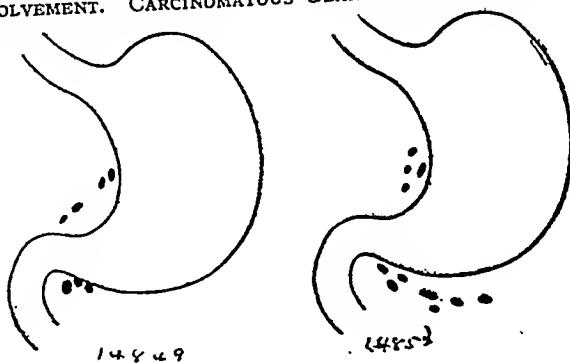
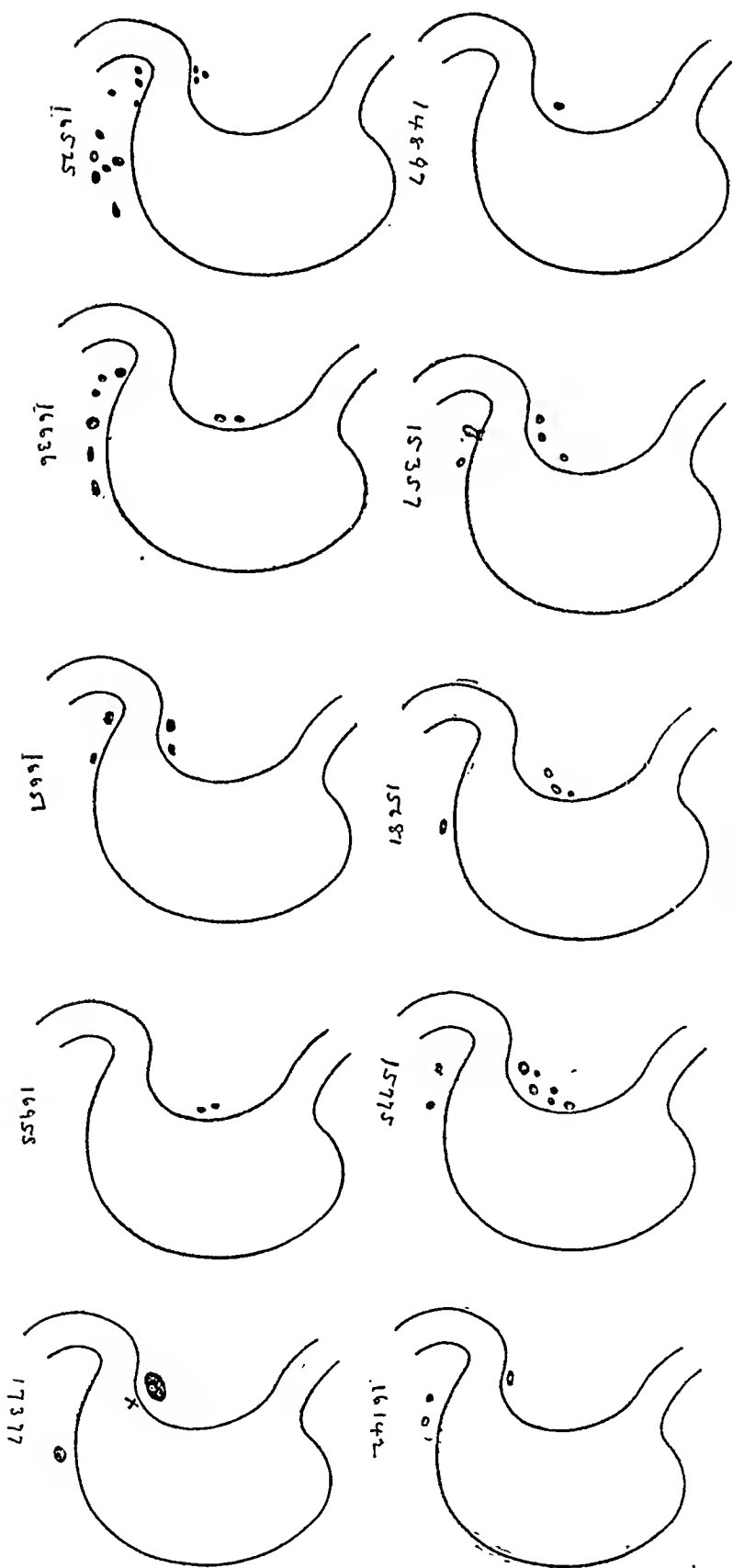


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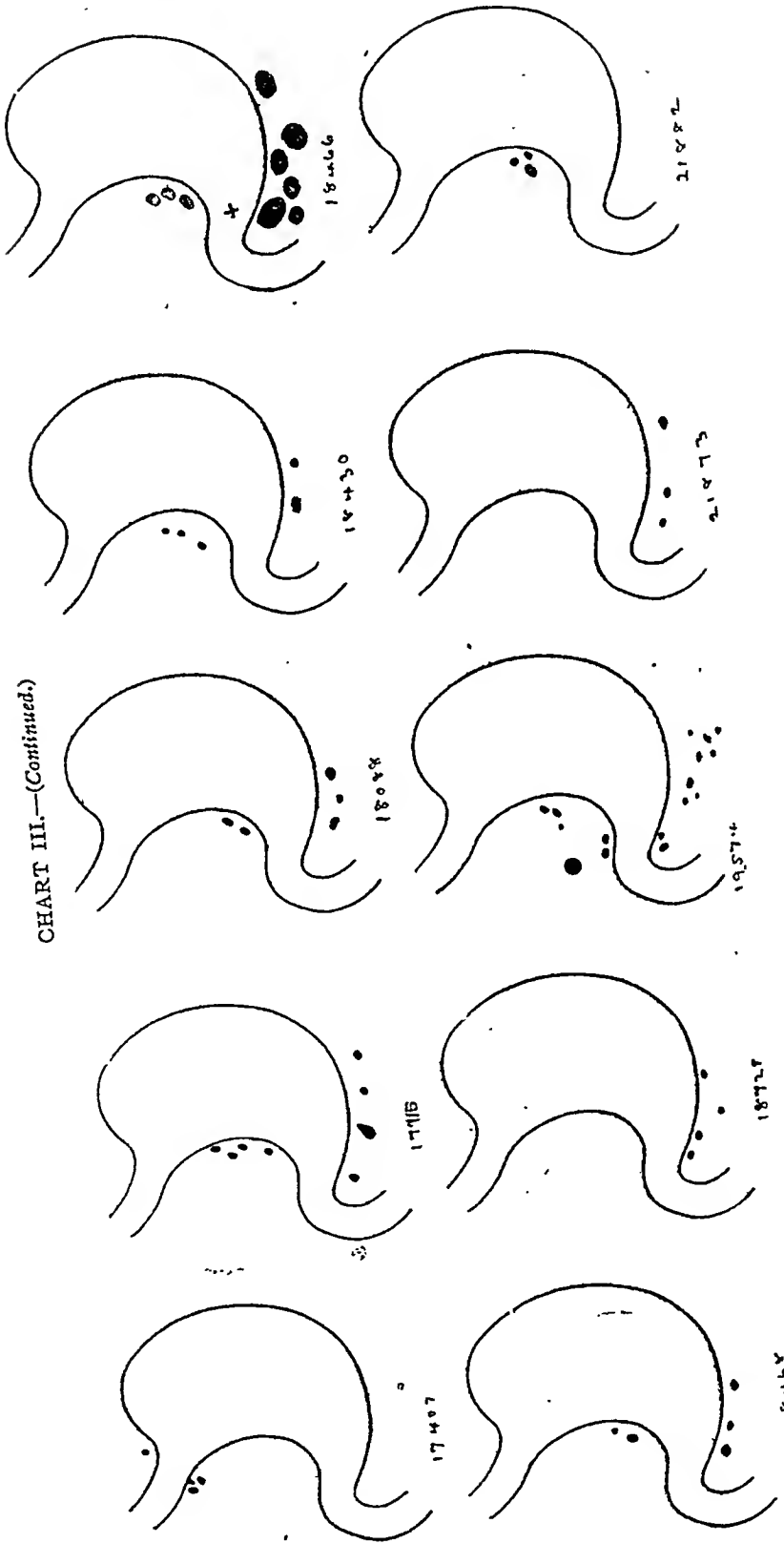


CHART III.—(Continued.)

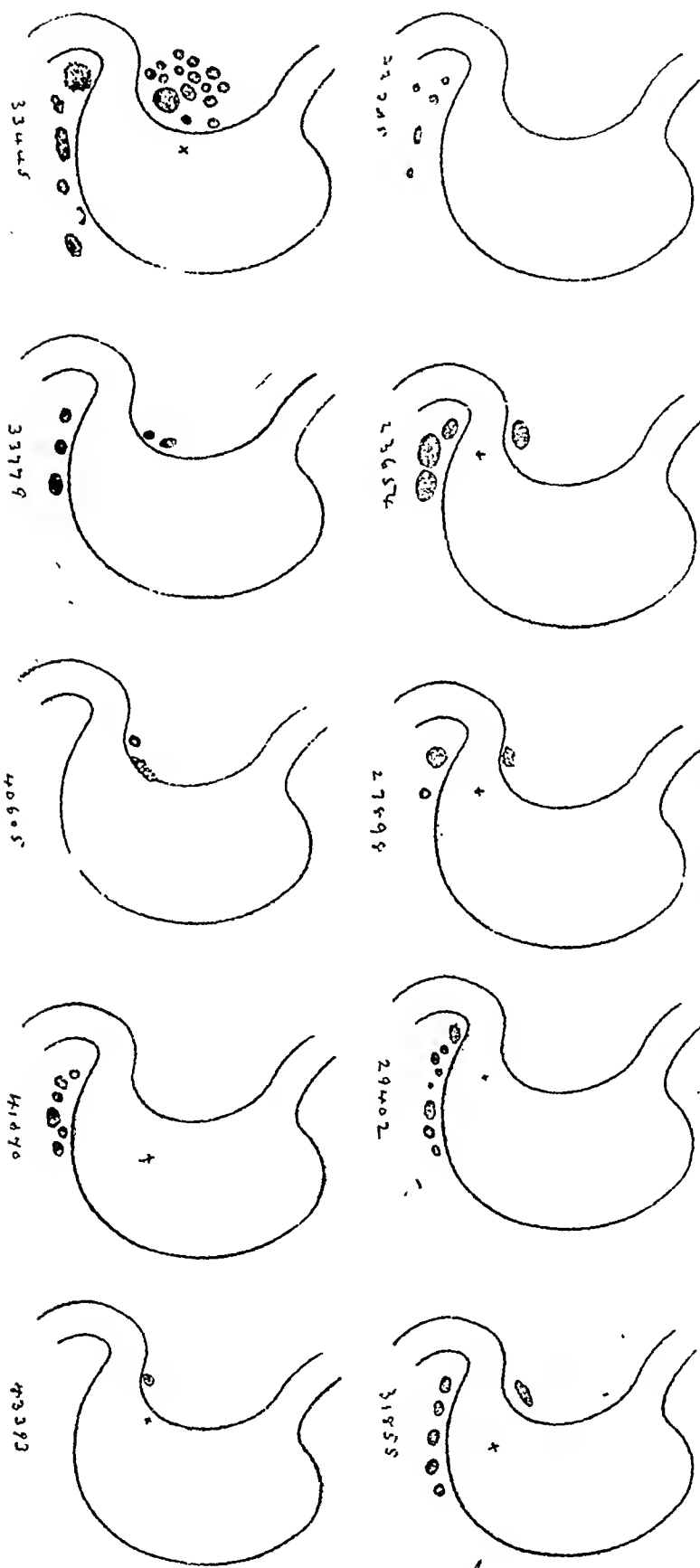


CHART III.—(Continued.)

CONGENITAL ABSENCE OF CÆCUM AND ASCENDING COLON.

BY P. LOCKHART MUMMERY, B.C.(Cantab.), F.R.C.S.(Eng.),
OF LONDON,

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THE colon begins to be differentiated from the rest of the alimentary canal about the sixth week of intra-uterine life. The cæcum first appears as a lateral protrusion of the alimentary tube. This protrusion forms just beyond the vitelline duct, and gradually increases in size except at its blind extremity, which remains narrow and becomes the vermiform appendix. As the alimentary canal increases in length it forms a loop, the lower limb of which forms the colon, which thus comes to be placed transversely in the peritoneal cavity lying in front of the commencement of the small intestine.

In the third and fourth month of intra-uterine life the cæcum lies at about the centre of the abdomen, while the remainder of the colon lies as a curved tube in the left hypochondriac and left iliac regions, attached by a mesentery to the front of the spine.

As the alimentary canal increases in length and the loop enlarges, the cæcum and upper part of the colon are carried upward and to the left, and then over to the right, so that the cæcum comes to lie under the liver in the right hypochondriac region. At this stage the colon resembles that found in the dog, cat, and other carnivorous mammalia in which there is no ascending colon.

Later still, the cæcum passes downward toward the right iliac fossa. In the eighth month foetus the cæcum is just below the right iliac crest, and the colon forms the typical inverted U of man. The causes of the descent of the cæcum into the right iliac fossa are somewhat uncertain, but it has been pointed out by Mr. Lockwood that in the eighth-month

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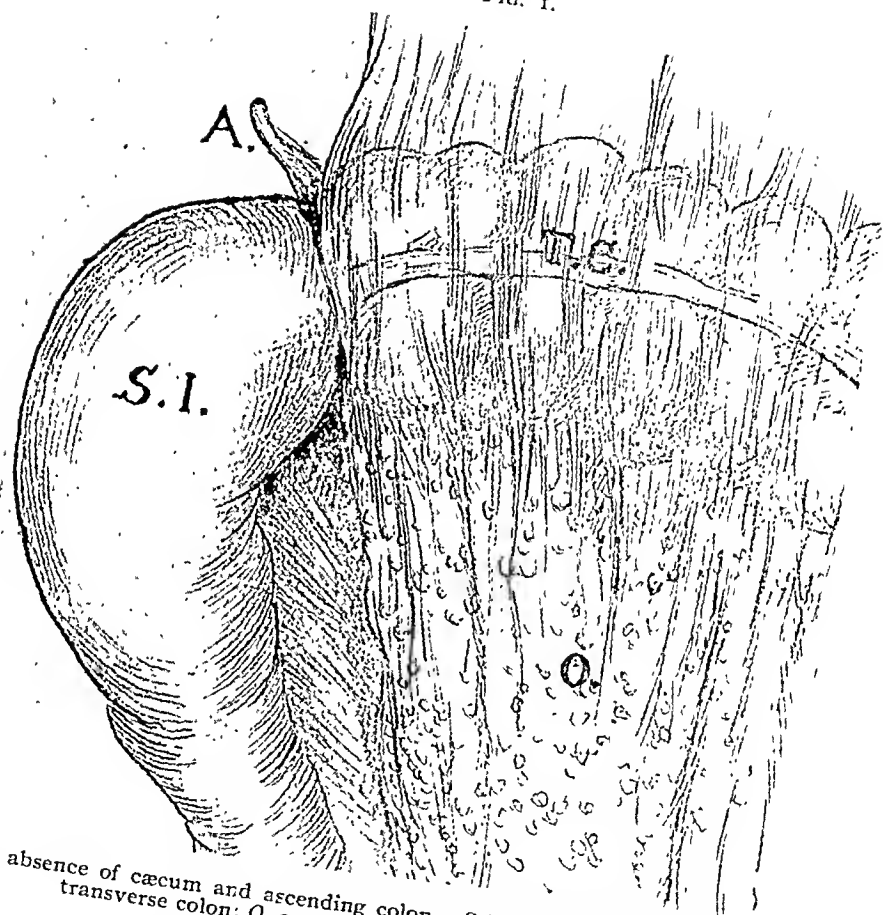
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FIG. 1.



Congenital absence of cæcum and ascending colon. S.I., small intestine (dilated), T.C., transverse colon; O, omentum; A, rudimentary appendix.

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foetus there is a band of peritoneum passing from the right testis to the cæcum close to the termination of the ileum, and he has suggested it as probable that the cæcum is carried down into the right iliac fossa by the descent of the testicle. Lockwood found that in the female foetus there is a similar relationship between the right ovary and the cæcum.

The commonest congenital abnormality of the cæcum is for it to have a mesentery and be freely movable. It may have a common mesentery with the whole of the small intestine. This abnormality gives rise to the cases in which the cæcum is found on the wrong side of the abdomen, and also to cases of cæcal volvulus. A rarer condition is for the cæcum to be arrested under the liver and for there to be no ascending colon.

The subject of this note had a still more rare condition in which the cæcum and ascending colon had entirely failed to develop, the small intestine joining on directly to the right end of the transverse colon. The ileum for about four inches before its junction was considerably dilated and was apparently functioning as a cæcum. The ileocæcal valve was entirely absent, but curiously enough a rudimentary appendix existed, or possibly this was a rudimentary cæcum, just at the site of junction between the ileum and transverse colon (Fig. 1).

The patient was a woman, aged forty-two, who was admitted to St. Mark's Hospital under my care for symptoms of ulcerative colitis. For about six months she had been suffering from continuous diarrhoea, the bowels acting about ten or fifteen times daily. There was considerable abdominal pain and discomfort; the stools contained blood and pus; the patient had lost weight; the temperature was raised, varying between normal and 100°.

A sigmoidoscopic examination revealed considerable ulceration in the colon and rectum, the ulcers being shallow and tending to be discrete. It was decided to perform appendicostomy with the object of enabling the colon to be kept flushed out.

Operation.—An incision was made over the appendix, under ether. On examination no cæcum could be found in the usual situation, and it was not until the colon was traced from the centre

of the transverse colon that the abnormality was discovered. It was then seen that the lower end of the dilated ileum terminated in the right extremity of the transverse colon just beneath the liver, the two mesenteries being continuous and the right end of the transverse colon being more mobile than normally. There was no evidence of any ileocæcal valve, but at the junction a small rudimentary projection, about one inch in length and about as thick as a quill, was seen on the upper surface. The whole of the colon was studded all over with ulcers which could be felt through the walls. No evidence of old adhesions was found.

A valvular opening was made into the ileum with a No. 6 catheter, about one inch of the catheter being buried in the wall of the ileum with Lembert sutures. This portion of the ileum was then sewn to the abdominal wall and the catheter brought out through the upper end of the abdominal incision, the remainder of which was closed in the usual way.

The opening acted quite well and there was no leakage when the catheter was not in place, though it was of course necessary for a small rubber plug to be worn in the opening in order to prevent its closing.

As a result of the operation the patient did very well. The diarrhœa and bleeding ceased, and within a fortnight normal stools were being passed. The ulcers, as far as could be seen, had healed at the end of three weeks, and the patient left the hospital in good health with instructions to continue washing out the bowel once a day.

It was noted at the time of operation that although no ileocæcal valve existed, the ulcers were entirely confined to the colon, none being found in the small intestine. At the point of junction between the ileum and transverse colon there was a well-marked point at which the longitudinal muscle bands of the large intestine started and which corresponded to the left free edge of the great omentum. There was nothing in the patient's history or in that of her family to account for the abnormality, nor did she appear to have suffered any inconvenience from not having a cæcum, unless possibly the fact that she had got ulcerative colitis can be attributed to it, which, however, seems improbable.

Complete non-development of the cæcum and absence of the ascending colon would seem to be a very rare abnormality.

A case is recorded by Prof. Elliott Smith (*Jour. of Anatomy and Physiology*, v, 58). The patient was a woman, aged twenty-five, in whom the ileum passed insensibly into the ascending colon without there being any cæcum or any trace of an ileocæcal valve. There was no splenic or hepatic angle to the colon, and the whole large bowel was provided with a long mesentery. A rudimentary appendix was present.

A case is mentioned by Professor Turner (*Edinburgh Medical Journal*, 1863, p. 110), in which there was congenital absence of the cæcum.

Lockwood records the case of a male, aged twenty-five, in whom the colon had not completed its descent into the iliac fossa and the cæcum was situated opposite the crest of the ileum (*Brit. Med. Jour.*, 1882, vol. ii, p. 574).

H. D. Rolleston (*Transactions Path. Soc.*, 1890, p. 130) records a case of congenital maldevelopment of the cæcum. The terminal portion of the ileum had no mesentery and the cæcum was of the primitive type and had not descended, but had remained in front of the right kidney.

A specimen of retention of the cæcum in the right hypochondriac region is in the Royal College of Surgeons' Museum.

Lockwood has pointed out the very interesting fact that in the eighth-month foetus there is a band of peritoneum connecting the right testis or ovary to the termination of the ileum on the right side, and that non-descent of the cæcum is frequently associated with undescended testis or a similar condition of the ovary. Unfortunately, in my case, this was not looked for. The condition found in this patient exactly resembles that normally present in many mammals notably the cat and dog.

PREVASCULAR FEMORAL HERNIA.

BY ALEXIS V. MOSCHCOWITZ, M.D.,

OF NEW YORK,

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THERE are several reasons which induce me to place on record the case about to be described: (1) the exceeding rarity of this variety of femoral hernia; (2) the paucity of the anatomical description of this form of hernia; and (3) the chaotic state of the literature and nomenclature pertaining to all forms of hernia not of the classical femoral variety.

M. M., fifty years of age, a native of Roumania, was admitted to the Har Moriah Hospital, April 14, 1911. A deformity of the right foot was noted at birth, and the lame gait, which developed when he began to walk, was ascribed to that. Fifteen years ago he noticed a reducible swelling in the right groin; suspecting a rupture, he attempted to wear a truss, but this became so irksome that he soon discarded it. Gradually the hernia became larger and larger, but, with the exception of its bulk, caused him no inconvenience. After lifting a heavy weight, five days prior to his admission to the hospital, the hernia suddenly increased in size, and became irreducible. This was accompanied by sharp pain in the hernia; he vomited repeatedly, and his bowels became constipated; the constipation, however, was not absolute, as movements were obtained by the aid of high enemata.

On examination it was found that the right lower extremity is shorter by 2 to 3 cm., and slightly smaller than the left. The right foot shows a well-developed pes cavus. The right hip-joint reveals nothing abnormal, and is freely movable; X-ray is negative.

There exists a small paraumbilical hernia.

At the junction of the right thigh and abdomen, there is a large globular swelling of approximately semilunar shape. Its diameters are equal, and approximately ten inches in length. It

imparts a sensation of fluctuation, and is dull tympanitic on percussion. It is somewhat painful and very tender on pressure, particularly at the line of Poupart's ligament. The swelling is irreducible, and gives only a doubtful impulse on coughing (Fig. 1).

The attributes of this swelling were so unusual as to lead me to suspect that it was a femoral hernia, with some peculiar features. Because of its large size and the incarceration, it was impossible to determine whether we were dealing with a huge premuscular or prevascular femoral hernia.

The patient was operated upon April 14. A vertical incision, about four inches in length, was made, from Poupart's ligament downward over the most prominent part of the hernial protrusion, and the sac opened. A large amount of blood-tinged, non-odorous fluid escaped. The sac was found to contain several loops of small intestine. Their reduction was very difficult, but was finally accomplished by manipulation in Trendelenburg's posture.

The neck of the sac was elliptical in shape, and easily accommodated my four fingers, placed side by side; it extended from Gimbernat's ligament to about one inch external to the femoral artery.

The sac, much thickened and easily the size of a large coconut, was now freed from the surrounding structures and lifted upward. When this was done, a most interesting and unusual picture was revealed. All the structures of Scarpa's triangle, with the exception of the anterior crural nerve, were seen, as in a dissecting room specimen; the femoral artery and vein, naked and without their sheath, coursing downward for a distance of about four inches. No saphenous opening was made out.

The radical (?) closure of this huge ring was now proceeded with after a method described by me in the *New York State Journal of Medicine*, October, 1907. The upper end of the cutaneous incision was extended in an upward and outward direction for a distance of about five inches, and Poupart's ligament exposed. The transversalis fascia covering Hesselbach's triangle was incised parallel to Poupart's ligament, and the sac (previously liberated from below) pulled up, thereby converting the femoral hernia practically into a direct inguinal hernia. The neck of the sac was now closed by a continuous suture, and the redundant portion resected. (It is to be noted, that at no time did I come

into conflict with the deep epigastric vessels.) Poupart's ligament was now joined by four chromicized catgut sutures to Cooper's ligament; this closed off that portion of the ring extending from Gimbernat's ligament to the femoral vein. There still remained a fair sized hole, extending from the vein outward, but the closure of this was left to a later stage of the operation. The inguinal incision was now closed, as it is usually done in an inguinal hernia.

The opening, remaining to the outer side of the vessels, was closed in the following manner: Chromicized catgut sutures were passed, catching the under surface of Poupart's ligament anteriorly, and whatever fascial, muscular, and aponeurotic structures existed posteriorly, namely the psoas, iliacus, and pectineus muscles, beginning at the extreme outer end of the ring, and continuing as far as possible toward the femoral artery. This still left an opening, which was sufficiently snug to transmit without constriction the femoral artery and vein. No attempt was made to close this remaining portion of the ring; nor for that matter, do I see any possibility to do this. Closure of the skin.

I regret extremely that I did not (owing to pressure of time, the operation had already lasted an hour and a half) resect the redundant part of the skin, and this is still to be seen in the accompanying illustration (Fig. 2).

First dressing April 21. Primary union resulted and patient left the hospital seventeen days after operation.

In order to fully understand this form of hernia, a thorough knowledge of the anatomy of this region is of prime importance. I shall not review this phase of the subject in any detail. It may be of interest to relate that some of the anatomists of the last century, Hesselbach, Cloquet, and Sir Astley Cooper, have practically said the last word on the subject. There are, however, inherent to this form of hernia special points, not widely known or appreciated, which have been brought home to me in the study of my case, and to these I would invite attention.

Primarily it is important to recall, that like all great vessels of the abdomen, the iliac vessels *lie upon* the transversalis fascia and are *covered* by the peritoneum. It follows, there-

FIG. 1



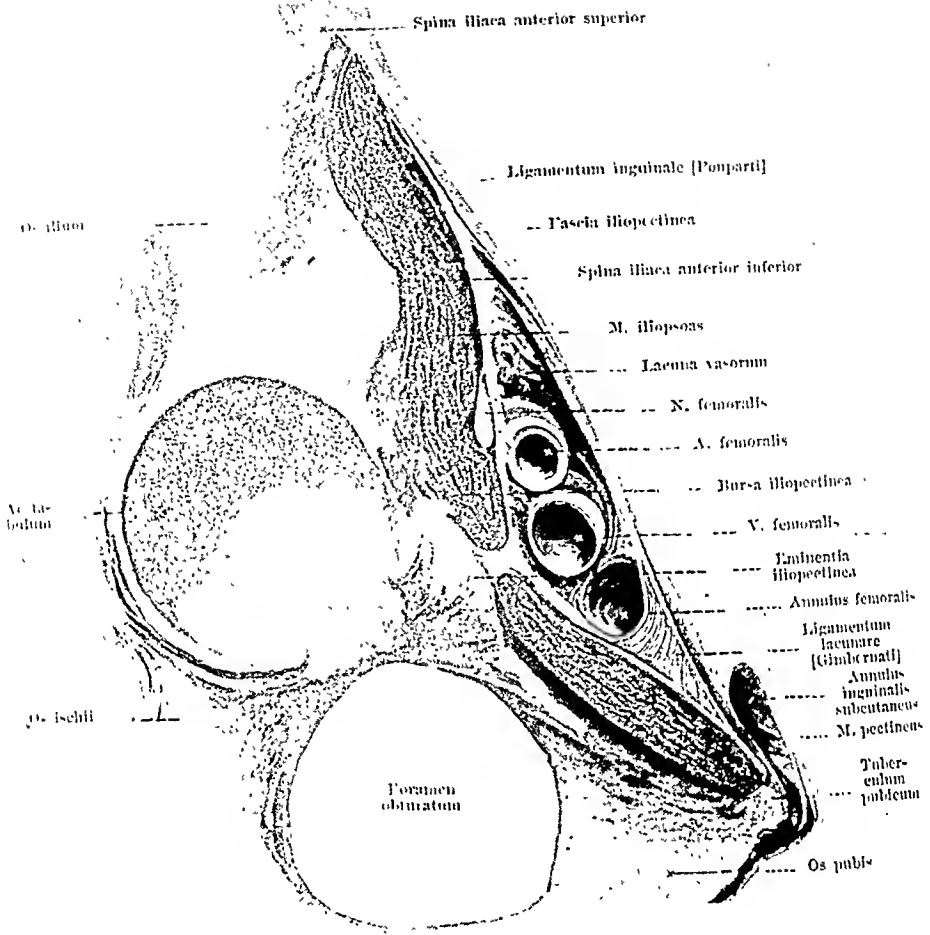
Prevascular femoral hernia, before operation

FIG. 2.



Prevascular femoral hernia, after operation.

FIG. 5.

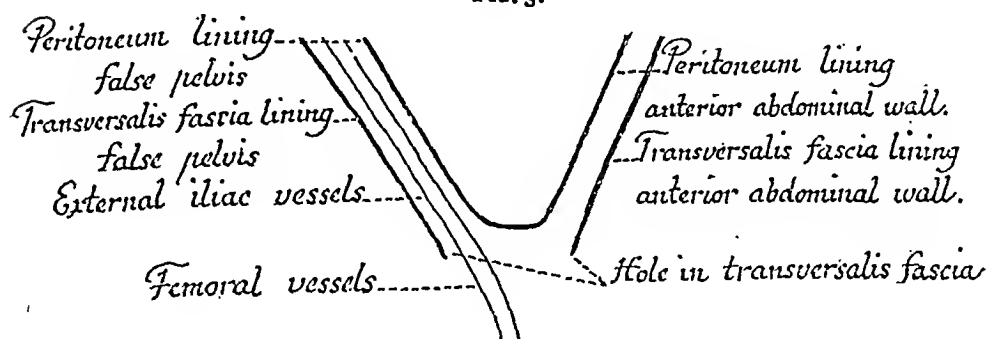


Cross-section of femoral region. (After Spalteholz.)

fore, that at that point where these vessels escape from the abdomen to the thigh, there must be an opening, or at least a weak spot in the transversalis fascia. To make this point clear, I have drawn the following diagram (Fig. 3).

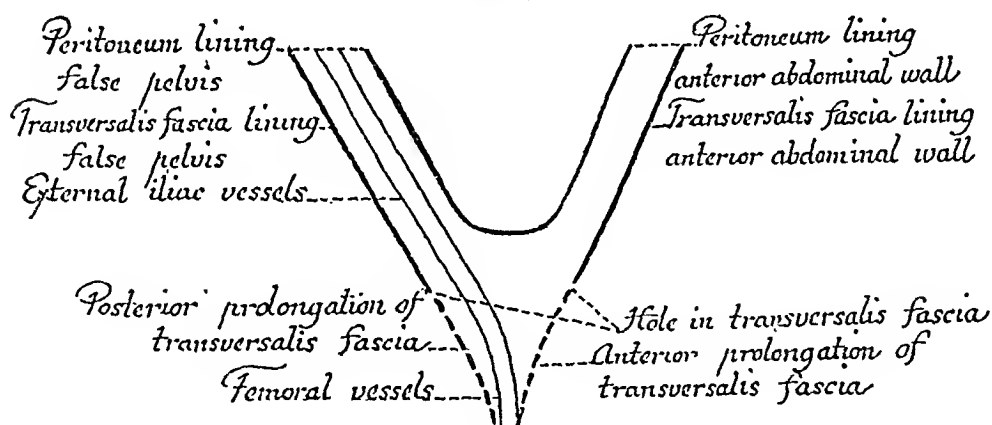
This hole in the transversalis fascia, strictly speaking, does

FIG. 3.



not exist. Careful dissections have shown that the posterior or pelvic portion of the transversalis fascia is prolonged for some distance behind the vessels, while the anterior part of the transversalis fascia is prolonged for a similar distance in front of the vessels, finally both becoming blended with the vessel

FIG. 4.



wall. To be more accurate, therefore, the following would be a truer diagrammatic cross-section (Fig. 4).

This prolongation, however, is nevertheless a weak point, and constitutes an avenue for the escape of a hernia.

Fig. 5 represents a cross-section of the femoral region,

made parallel to Poupart's ligament, and is copied after Spalteholz. It is seen that the irregular space behind Poupart's ligament is divided into two halves, of which the outer one is called the lacuna muscularis, and gives passage to the iliopsoas and anterior crural nerve, while the inner one, called the lacuna vascularis, gives passage to the femoral artery and vein, leaving a practically empty compartment to the mesial side of the vein, containing only Rosenmüller's gland and lymphatic vessels, and which is the loculus of the usual variety of femoral hernia.

These being the theoretical anatomical substrata of a prevascular femoral hernia, let me now again recall the operative findings in my case, and see in how far the actual findings of a case compare with the findings as they should be in theory.

First of all, the hernial ring was oval, of a flattened shape, extending from Gimbernat's ligament up to about an inch to the outer side of the femoral artery, easily admitting my four fingers. Now this we never see in an ordinary femoral hernia; no matter how large the hernia, the hernial ring is usually small and round, and the fascial compartment to the outer side of the ring is so dense that not even the femoral vein, much less the artery, can ever be seen.

Second, long before I proceeded with the radical cure of my case, *i.e.*, just after I had peeled off the infrapoupartian portion of the sac, I was able to demonstrate to various visitors and my assistants a perfect anatomical exposure of at least five inches of the femoral artery and vein, which showed not the slightest trace of a covering. This, to my mind, is an absolute and incontrovertible proof that we had before us a prevascular femoral hernia. The conventional warning, not to injure the femoral vessels when passing the sutures, is not necessary in this form of hernia. The sight of these structures is sufficient.

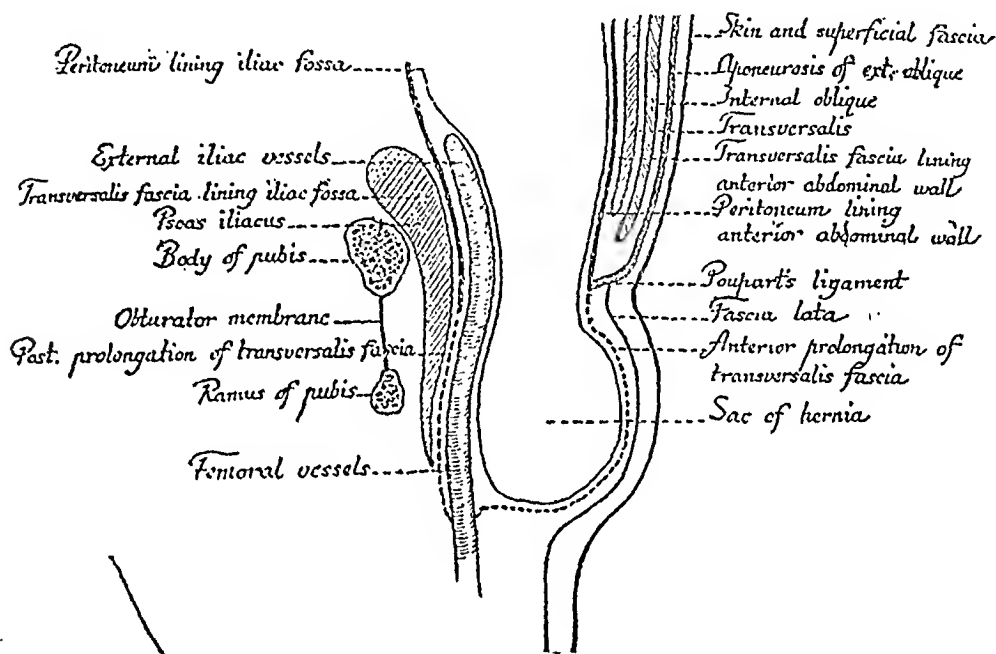
Anatomically, a cross-section of a prevascular femoral hernia can be represented by the following diagram (Fig. 6).

It is seen that the coverings of such a hernia are of the simplest, *viz.*: (1) skin and superficial fascia; (2) fascia lata;

- (3) prolongation of abdominal portion of transversalis fascia;
 (4) peritoneum.

Now all these were present and readily demonstrable during the operation. The important point to remember, however, is that the sac necessarily rests directly upon the femoral vessels. I contend that it is upon this anatomical fact, and this fact alone, so beautifully demonstrated in my case, that a diagnosis of prevascular femoral hernia can be made.

FIG. 6.



Cross-section of prevascular femoral hernia.

Deep Epigastric Artery.—The relation of the deep epigastric artery to this form of femoral hernia is of importance and interest. *Eo ipso* it is evident that the hernia, coming from above, must come into close relationship with the artery. Narath concedes this, and furthermore argues that as a part of the hernia becomes evident, even after stopping up of the femoral canal with the finger, therefore the deep epigastric artery must lie medially to the hernia.

But this is not necessarily so. The deep epigastric artery is rather tortuous in this part of its course, and lengthens or shortens itself, according to requirements. I believe the posi-

tion of the deep epigastric artery depends upon where the hernia *begins*; if the hernia originates on the outer side of the deep epigastric artery, then the artery is pushed toward the median line; if on the inner side, then the artery is pushed toward the outer side. In my case, I believe the deep epigastric artery was on the outer side, for the following reasons: that prior to deligating the neck of the sac, I made a pretty liberal incision through Hesselbach's triangle, and felt the deep epigastric artery to the outer side, but never again did I come into conflict with these vessels. While in my case the deep epigastric artery was to the outer side of the neck of the sac, I concede that in some cases it may be to the inner side. The point is that the position of the deep epigastric artery is of no diagnostic consequence.

REVIEW OF HITHERTO REPORTED CASES.

Fabricius (*Wiener klinische Wochenschrift*, 1895, p. 554): This paper was primarily intended to advocate the superior advantages of the inguinal route for the cure of ordinary femoral hernia. The case was mentioned incidentally and but very briefly. Even from the short description, however, I have no hesitancy in stating that the case was a true case of prevascular femoral hernia.

Zinner (*Deutsche Zeitschrift für Chirurgie*, vol. ciii, p. 137) reports a case of strangulated obturator hernia, which was complicated by a bilateral femoral hernia, and one of these proved on autopsy to be a prevascular femoral hernia.

In Teale's "A Practical Treatise on Hernia," London, 1846, I find the statement that Stanley met with two instances of prevascular femoral hernia in the cadaver. In each the sac was small, wide at the mouth, and empty. It passed out of the abdomen close to the femoral vessels, and was placed in front of them. I have not been able to trace this statement to its original source.

It is very surprising that in spite of the extreme rarity of this form of hernia, mention is frequently made in literature

of the possibility of such an occurrence (Pilcher, Bähr, etc.), but as far as I can ascertain, such cases were not recorded.

Conceding Stanley's two cases, our case, therefore, is the fifth, or if Stanley's cases are excluded, our case is the third, sufficiently rare, we believe, to merit a report.

These are the cases that I find recorded, and which, in contradistinction to those about to be described, may be called "spontaneous"; I refer to the six cases of Narath (*Archiv. für klinische Chirurgie*, vol. lix, p. 396): Über eine eigenartige Form von Hernia cruralis (prevascularis) im Anschlusse an die unblutige Behandlung angeborener Hüftgelenkverrenkungen.

Narath reports six cases of this form of hernia (two bilateral) after the bloodless reduction of 65 congenitally dislocated hips. It is only right to mention that considerable difficulty was met with to retain the head of the femur in the cotyloid cavity. Reluxations and anterior dislocations occurred with great frequency, requiring frequent narcoses and frequent manipulations. None of these cases were operated upon; hence exact anatomical proof is lacking. However, Narath's description is so perfect that, to my mind, there cannot be the slightest doubt that these six cases, although of a "traumatic" origin, are true cases of prevascular femoral hernia. Into this group there very probably also belongs the case published by Borchard (*Deutsche Zeit. f. Chir.*, vol. lxvi, p. 572).

My case is of especial interest, particularly in connection with Narath's contribution. The patient is lame and has a peculiar walk. This is to be accounted for by a shortening of the right lower extremity to the extent of 2 cm., slight atrophy, and by the presence of a shorter foot and a well-marked pes cavus. In view of Narath's cases, I suspected that we were also dealing with a congenital dislocation of the hip, but there is no trace of such deformity to be seen, either by examination or by X-ray. I have no doubt that the presence of the prevascular femoral hernia in this case is due in a great measure, if not wholly to the congenital deformity of the lower extremity, though it is difficult to explain satisfactorily this relationship.

DIFFERENTIAL DIAGNOSIS BETWEEN PREVASCULAR FEMORAL
HERNIA AND OTHER ABNORMAL VARIETIES OF
FEMORAL HERNIA.

Just a word or two regarding the differential diagnosis of prevascular femoral hernia and other forms of femoral hernia, in order to show what were the criteria which prompted me to accept some and exclude other cases.

1. Hesselbach's hernia passes to the outer side of the femoral artery, lying wholly in the lacuna muscularis.

2. Cloquet's hernia passes through the femoral canal to the inner side of the femoral vein; it, however, does not, like an ordinary femoral hernia, escape from the saphenous opening, but spreads out upon the pectineus, and is covered by the fascia lata.

3. Laugier's hernia escapes through a defect in Gimbernat's ligament.

4. In some articles I find mentioned a retrovascular femoral hernia. I deny, however, the possibility of such an occurrence.

As far as I could ascertain in a careful search of the literature, the case here reported is the first case of prevascular femoral hernia operated upon and studied *in vivo*.

OBSERVATIONS ON THE RADICAL CURE OF HERNIA.*

BY CHARLES F. NASSAU, M.D.,

OF PHILADELPHIA.

FEW subjects are of such perennial interest as hernia. In these days when most surgeons and even the occasional operator feel that they are protected by an indefinite fetish, by some termed aseptic by others antiseptic surgery, many patients are subjected to a so-called radical operation for the cure of hernia. Often operations seem to be performed with the idea that if the wound does not suppurate the hernia will be cured. Fortunately this is true in many cases. To operate upon a condition sometimes maiming but seldom mortal is to me a solemn procedure. How lightheartedly and carelessly many cases of hernia are subjected to operation by men who do not have even a hazy understanding of anatomy many of us know.

It is not the intention of this paper to magnify or to look upon as marvellous a properly performed operation. The mere technical and mechanical considerations entering into the surgical cleanliness and the plastic disposition of the tissues are simple. Like many simple things complications are often made artificially.

We shall confine our remarks to a consideration of inguinal hernia. Of the many operative procedures in vogue previous to the papers by Halsted and by Bassini, radical cure was a dubious outcome. To Halsted more than to any other man, we owe our knowledge of the causes of recurrence. In the exhaustive paper by Bloodgood (vol. vii of *The Johns Hopkins Hospital Report*) can be found the most careful analysis of the causes of failure and reasons for success ever published in any paper on hernia.

* Read before the Philadelphia Academy of Surgery, March 4, 1912.

As you know, Bassini transplanted the whole spermatic cord so that it made its exit at an outer and higher level, and lay between the internal oblique muscle and the aponeurosis of the external oblique muscle. It is obvious that in direct hernia and in indirect hernia with atrophy of the conjoined tendon Bassini's operation is deficient. In Halsted's early operations he laid special emphasis upon reducing the size of the spermatic cord by excision of most of the veins. The vas deferens with its artery and a few veins was left as a thin structure, and was transplanted into the upper angle of a short incision through the lower border of the internal oblique muscle; one suture was placed above the cord, including in its grasp the aponeurosis of the external oblique muscle and the internal oblique. The next suture was placed below the cord, including the internal and external oblique, a special attempt being made to draw down the internal oblique muscle in such a way that in the continuation of the suturing the so-called new canal was lined by muscle tissue. After the introduction of a single row of deep mattress sutures the thinned spermatic cord lay beneath the skin. This was the fundamental Halsted operation; it has since been much modified. The edge of the internal oblique muscle is no longer cut, and the reason is obvious when one studies the distribution of the nerve supply. As a further advance Halsted has called attention to the fact that if the veins of the cord are excised it must be done only when the vas deferens is not torn from its bed and not transplanted. The utilization of the fibres of the cremaster muscle and the overlapping of the aponeurosis of the external oblique are later developments of Halsted's method.

The operation of Ferguson of Chicago is but a wider application of the principle, that in certain cases it is not wise nor necessary to transplant or even to disturb the spermatic cord.

For the past seven and a half years, except in direct hernias and not always then, we have not transplanted the spermatic cord, unless demonstrating the typical Bassini operation to students.

It will, we think, be granted that the higher the sac is obliterated, the better. In congenital and in sliding hernia of the sigmoid the surgeon is confronted with difficulties. For more than seven years, however, in all ordinary hernias, where there has been a well-defined sac that was not too thick, and when no adhesions were present in the sac or around its internal orifice, the inversion transposition method of Kocher has always been our choice. We have called attention to these few points with a definite purpose. We have now arrived at the point where Bloodgood's transplantation of the rectus muscle can be described, and emphasis placed upon the fact that, of all improvements introduced into the operation for hernia, this, indeed, is the most valuable.

It is true that Wölfler had described a so-called transplantation of the rectus muscle at the same time or perhaps previous to Bloodgood's publication.

Wölfler opens the anterior sheath of the rectus muscle and attempts to pull the side belly of the muscle over to Poupart's ligament, with the hope of course of supplying the deficiency in the conjoined tendon. It is apparent to any one versed in the anatomy of hernia that it would be necessary to drag the muscle over the front of the remaining outer portion of its sheath and over the inner portion of the internal oblique—a process almost impossible without devitalizing tension.

Bloodgood, in his transplantation, utilizes the outer border of the rectus muscle behind the internal oblique and just in front of the peritoneum, or, as a matter of fact, the bladder. In this way the outer edge of the rectus is available for the introduction of sutures, from the point of its insertion below to a point two or three inches above. The strong, thick muscle is easily brought over the site of the direct hernia, and always three and sometimes five interrupted sutures can be used to fasten it along the inner shelf of Poupart's ligament. Any remnants of conjoined tendon can be sutured on the anterior surface of the muscle, and farther out the internal oblique and cremaster muscles can then usually be sutured to the outer half or two-thirds of Poupart's ligament without tension.

The aponeurosis of the external oblique may be closed with a continuous suture, or the aponeurosis may be overlapped by one row of mattress and one row of ordinary interrupted sutures.

Widely divergent methods of skin suture are used according to the fancy of the individual operator.

The Cause of Failure.—Primary healing is an absolute essential in the perfect cure of a hernia, although a slight degree of skin infection may cause no actual harm if the deeper structures are not involved.

We believe, however, that wound infection is probably the most frequent cause of failure. Probably the most frequent cause of wound infection is that type described by Kocher as lesion infection. Given an operating room technic of a perfection that lowers the introduction of organisms into the wound to a harmless minimum, with careful handling of the wound and clean dissection, one attains the ideal result. If, however, fingers are introduced too frequently into the wound, parts are violently retracted and tissues torn apart by rough dissection; if there is carelessness, in hæmostasis, the tissues becoming blood stained; if there is too much tension in the sutures, then we shall have the lesion infection of Kocher and Tavel, and, undoubtedly, contribute in a very marked degree toward unfavorable healing. An extremely common cause of failure is the neglect on the part of the operator to properly appreciate the best way to distribute the structures at his command.

In many individuals the arching fibres of the internal oblique and transversalis muscles are frequently deficient even where the hernia is not of the direct type. In these cases and in all direct hernias Bloodgood's transplantation of the rectus muscle must be performed, not as a matter of choice but as a matter of necessity, if the hernia is to remain cured.

Method of Rectus Transplantation.—After the ligation of the neck of the sac, a small retractor is placed under the remnants of the conjoined tendon, the pull being upward and slightly toward the median line. With the finger-tip or long

dissecting forceps, any anterior bulging of the bladder is prevented, and a longitudinal incision is made along the outer border of the rectus muscle, exposing it to a distance of from two to three inches. A traction suture is then placed so as to grasp a large part of the belly of the muscle so that it can be drawn out from its sheath over toward Poupart's ligament. Suturing is begun from below upward. Usually from three to five sutures are introduced so that the entire area occupied by a direct hernia is covered by thick muscle. Care should be taken not to introduce these sutures in the same plane along the muscle to avoid splitting it.

The next step is to bring down the internal oblique muscle to Poupart's ligament, certainly along its outer half, and if possible so as to overlap the rectus; all that remains is the suturing of the aponeurosis of the external oblique and the skin.

Choice of an Anæsthetic.—In children up to the age of sixteen or seventeen and in neurotic individuals some form of general anæsthesia is as yet the necessary evil. In young adults, in the aged, and in all strangulated hernia, except in children, we believe that general anæsthesia should be avoided as far as possible. We strongly believe that a general anæsthetic given to a case of long-standing strangulation frequently turns the scale toward death. At the present time, methods of operating under local anæsthesia, as laid down by Dr. Mitchell of Washington, are so exact and so painless, that one who has given any study to the method will no longer use ether.

A study of the article by Cushing on "The Nerve Distribution of the Inguinal Region," a little practice in infiltration and nerve blocking, together with gentleness in handling tissues, render the method one easily learned after some experience.

The infiltrating solution that has given the best results in our hands is that recommended by Mitchell. The solution is made in two strengths. The strong solution is made by dissolving a hypodermic tablet containing $\frac{3}{4}$ grain of cocaine

and 1/400 grain of adrenalin in 50 c.c. of normal salt solution. The weak solution contains the same strength tablet in 100 c.c. of salt solution. These tablets should be sterilized in very small cotton stoppered vials with dry heat, raising the temperature gradually during one hour to 100° C. Only two tablets are sterilized in each vial and they should be placed in cotton to avoid contact with glass. After experimenting with various syringes the best has been found to be the Record of 2 c.c. capacity.

The first thing to accomplish in operating under local anæsthesia is to prevent the patient from believing that anything unusual is about to take place. In fact the best way is to say very little in way of explanation. If any question is raised, let it be known that the operator is not using ether as a mark of special favor to the patient.

A few quiet words to the effect that: "We are going to operate together, and if by any chance you feel any pain let me know," will create a proper mental attitude.

The patient's general nervous sensibilities are usually less on edge if a hypodermic injection of 1/4 grain of morphine is administered a few moments before operation is begun.

Space is too limited to enter into a minute description of operation under local anæsthesia, but the points essential are: (1) Careful skin infiltration (strong solution); (2) perfect blocking of the iliohypogastric and ilio-inguinal nerves (strong solution); (3) avoiding unnecessary handling of tissues; (4) absolute prohibition as to gauze dissection; (5) fore-warning patient that at this or that point some discomfort may be felt for a moment until a fresh infiltration with the weaker solution can be made.

The post-operative course of a patient operated upon under infiltration anæsthesia is so much more comfortable than with the use of ether that it is hard to institute comparisons.

The cases now reported comprise those operated upon in St. Joseph's Hospital up to May 1, 1909, at Frankford Hospital up to May 1, 1910, and at Jefferson Hospital to October 1,

1911; three operations on two patients at the Presbyterian Hospital, the last one in June, 1907.

A very large proportion of the Jefferson Hospital cases I owe to the courtesy of Dr. J. Chalmers DaCosta.

Statistical Summary.—Total number of operations, 133 on 119 patients.

Age varied from 35 days to 75 years.

There were 28 cases of strangulated hernia with 5 deaths.

One case of partial suppuration requiring removal of silk suture, result is perfect cure.

One case recurred in six months at site of transplanted cord.

Edward C., right inguinal hernia. Operation, St. Joseph's Hospital, Jan. 29, 1904. Kangaroo tendon sutures. Healing p. p. Re-operated at another hospital during my absence and was seen in September, 1904, with a second recurrence and a stitch sinus.

There were no deaths in the non-strangulated cases.

THE VALUE OF ARTERIOVENOUS ANASTOMOSIS IN GANGRENE OF THE LOWER LIMB.

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DURING the last decade the efforts of surgeons and of experimental workers have been more than ever directed to the advancement of the conservative treatment in disease—that is to say to the increase of our knowledge and capacity to replace and repair damaged tissues. The possibilities of grafting have been found to be a most fascinating and instructive study, and the satisfactory replacement of some damaged, diseased, or absent organ or structure affords the surgeon probably greater gratification than any other form of surgical success. Plastic bone and joint surgery, plastic operations for the remodelling of the face disfigured by injury or disease, the repair of damaged nerves, and the restoration of motor power and sensibility to parts previously useless, the utilization of veins for the replacement of arteries or the urethra, the reconstruction of the pharynx and mouth after extensive excisions for malignant disease, and in animals the successful transplantation of kidneys are some of the most important triumphs which have been attained in recent years.

The great and progressive diminution in the number of amputations which are done each year is also a striking testimony of the improvement in our knowledge and technic. But there are yet certain groups of cases in the treatment of which amputation is still the only certain means of saving the patient's life. Outstanding among these groups in the number of victims it claims each year is that in which gangrene is the prominent symptom.

Comparatively recently, and not so much as the result of a special effort directed against the condition as an offshoot from the vast amount of experimental work on the possibilities of surgical interference on the blood-vessels, attempts have been made to check the onset or spread of gangrene and to relieve the distressing attendant symptoms by renewing

the blood supply to the affected part. Gangrene, however, is not a disease in itself, it is but a manifestation of some pathological changes occurring in the body. Where, therefore, gangrene occurs in the course of some constitutional disturbance, such as diabetes, or as the result of some local trauma or infection, such as carbolic acid or hospital gangrene, the treatment cannot necessarily be the same as in those cases in which an obstruction of a main artery is the exciting cause. It becomes necessary, therefore, to have a clear knowledge of the etiological factors which can produce the symptom so as to be able to recognize in what cases a renewal of the circulation, if successfully effected, might arrest or even cure the gangrene.

Gangrene may occur as a symptom in various infective processes, either as the result of organisms which tend to produce gangrene as in hospital gangrene or gangrenous cellulitis, or in the course of constitutional conditions which favor the development of pyogenic organisms such as diabetes and the acute specifics. Local trauma, whether mechanical or chemical, may also produce gangrene. In by far the greater number of cases, however, gangrene is the expression of some pathological change in connection with the blood-vessels, and as it is this class of cases that most concerns us, a fuller classification of the defects in the vessels liable to produce a

CLASSIFICATION OF LESIONS OF THE CIRCULATORY SYSTEM WHICH MAY RESULT IN GANGRENE:

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| (a) ARTERIAL DISEASE MAINLY:
Endarteritis obliterans (erythromelalgia).* | (c) ARTERIAL SPASM:
Ergot;
Raynaud's disease;
Frost-bite. |
| (b) ARTERIAL DISEASE AND THROMBOSIS:
Endarteritis;
Calcification:
Senile;
Bright's disease;
Syphilis. | (d) LOCAL INTERRUPTION OF ARTERY:
Embolism;
Thrombosis (post-febrile);
Injury;
Ligature. |
| | (e) ACUTE ARTERIAL DISEASE:
Acute inflammation;
Syphilis. |

* The pathology of this condition is still so obscure that it is very difficult to know whether erythromelalgia should be included in this classification, but for the purpose of discussion in regard to the treatment of it erythromelalgia is inserted under the sub-heading of "arterial disease mainly."

deficiency of circulation to the part dependent on them for nutrition may be given.

It is obvious that it is in cases of gangrene associated with only some of the diseases of the circulatory system mentioned in the above classification, and even then under certain special conditions only, that any advantage can be expected from an improvement in the circulation. Were it possible to deviate the blood from the main artery into fresh channels, so that it flows to, through, and from the capillaries in the immediate neighborhood of the gangrenous part, this would certainly tend to limit the spread of the gangrene when such was due to endarteritis obliterans, to senile or syphilitic endarteritis, or to calcification of the artery, provided always that the general state of the patient, the amount of albumin in the urine, and the presence of extensive suppuration tracking beyond the gangrene were not contraindications. Under certain circumstances it might be possible similarly to arrest or improve the gangrene developing as the result of any of the causes included under "local interruption of the artery." In embolism and thrombosis, however, the extent of the associated œdema of the part or the seriousness of the disease which was the primary cause of the vascular condition, and in injuries the extensiveness of the damage to the tissues other than the vessels, will most probably render any such operation impracticable. On the other hand, when gangrene has followed ligature for aneurism or a partial resection of the artery, the possibilities of success are very much greater, as the vessels are less likely to show marked pathological changes such as calcification which increases the technical difficulties and the risk of subsequent thrombosis.

Finally there are the two conditions, erythromelalgia and Raynaud's disease. I have not found in the literature any suggestion that the distressing phenomena which form part of the clinical picture of these diseases might be relieved by deviating the blood stream from the affected artery into the vein. Yet it seems to me that in those cases where amputation is required, either for relief of pain or on account of gangrene, and especially as in such cases also the arteries are generally

pliable, uninflamed, and uncalcified, some effort should be made to relieve the symptoms and save the limb by doing an arteriovenous anastomosis.

It was in 1902, in a case of senile gangrene, that the first attempt was made by San Martin y Satrustegui¹ to revascularize the affected foot and arrest the progress of the gangrene. He hoped that if the blood could be diverted into the vein the resistance of the valves might be overcome by the force of the stream, which could then reach the peripheral capillaries: since the arteries were obliterated by the disease, the de-oxygenated blood obviously could not be returned into the venous circulation by this route, but would have to find some other channel of return. That the arterial blood does find its way through the vein to the periphery of the limb is proved by the immediate results. Permanent success, however, has been found more difficult to obtain, owing to the subsequent obliteration of the new channel by thrombosis in the vessels or the narrowing of the arteriovenous junction. The frequency of these complications is probably due not so much to any defect in the principle of the operation as to the technical difficulties in carrying it out. In their endeavor to avoid these complications, the various surgeons who have done the operation have tried different methods of anastomosing the vein and artery, and the four methods adopted have been lateral anastomosis, end-to-end anastomosis with eversion of the intima, intubation anastomosis in which the divided central end of the artery is stitched to an oval opening cut in the side of the vein, and invagination anastomosis, the artery being drawn into the divided open end of the vein.

The numerous experiments on animals by San Martin y Satrustegui, Franz,² Carrel,³ Morel,⁴ Guthrie,⁵ and others have shown that anastomosis of vessels by the invagination method is very unsatisfactory, and that the lateral anastomosis does not give such good results as the end-to-end and the end-to-side anastomosis; their findings in the work done on animals have been very fully corroborated by the results of the operations performed on man. The clotting which occurs after the operation and which is one of the most frequent causes of

failure, may form at the junction of the vessels, at the nearest valve in the artery, or in the artery itself. Sometimes the valves in the femoral vein do not immediately give way before the arterial blood, but yield gradually within the first few hours; clotting and permanent obstruction may, however, develop before the valves have had time to yield. To render the valves incompetent, it has been suggested that a bent wire should be passed into the vein and the valves hooked and torn; such a procedure must necessarily predispose to, rather than prevent, clotting. The most serious predisposing factors to clotting are undoubtedly the bruising of the vessels specially at the line of juncture, the bruising of the surrounding tissues, the leakage of blood from the anastomosis, and finally sepsis, using the term sepsis to include not only the grosser varieties easily recognizable by the production of pus but also all minor grades however slight of infection.

When the anastomosis has been successfully accomplished and the clamps have been removed from the vessels, the vein immediately becomes dilated with blood, as far at any rate as the next valve, and pulsates like an artery. This pulsation can sometimes be felt in the veins of the leg, but its presence or absence does not necessarily imply success or failure. In the 26 cases collected by Monod and Vanvards⁶ in which the operation was done for gangrene or threatening gangrene, distention of the superficial veins of the limb was noticed four times and pulsation 12 times. In three of these latter cases the pulsation disappeared after the first few days, and the cause of this was found in one case to be the formation of a clot. The most certain indication of the success of the operation is that the foot becomes warm and the pain and cramp, usually present before the operation, diminish and disappear. If the anastomosis continues to be efficient, the advancement of the gangrenous process stops and that part already destroyed becomes marked off from the living by a line of demarcation, while the discolored areas begin to assume a more healthy appearance. But in many of the cases the new channel becomes obstructed by the formation of a clot, and the gangrene which may have been temporarily arrested

continues to spread. Yet even in some of these cases the operation has been found of great service, since it has been possible to amputate with success through the lower third of the leg and even through the foot as a result of the improvement in the circulation.

A study of these cases shows that the operation is not the unqualified success it was hoped it might be, and for this reason some authors have attempted to condemn it completely. Compared with the means previously at our disposal the operation has shown considerable advance, since not only have patients with actual gangrene recovered and enjoyed a period of relief from pain and of restoration of function for some months at any rate, but in other cases it has been possible, by doing a local amputation in addition, to obtain immunity from return of symptoms for much longer periods.

Of the 36 cases recorded, there are five in which the disease has been completely arrested for some months; in Ballance's case there was progressive improvement until the time of the patient's death from an abdominal lesion five months later; one of Tuffier's and one of Wieting's patients left the hospital with the previously diseased foot painless and serviceable; Glasstein's patient was well three months after the anastomosis, while in the author's case all symptoms disappeared, the gangrenous areas separated, and the patient has remained well and able to walk about.

To these five cases must be added two, one operated on by Satrustegui and one by Wieting, in which in addition to the anastomosis a strictly local amputation of the toe or foot was done. The result of both was perfectly satisfactory.

It must be remembered that the number of patients on whom the operation of arteriovenous anastomosis for gangrene has been done is small and that greater experience is required to determine the choice of case and of technic. The operation is not an easy one, and the technic employed for controlling the hemorrhage and for uniting the vessels has varied greatly. There is no doubt that many of the cases operated on were not suitable on account either of the state of the gangrenous part, the extent of the thrombosis, the advanced age, or the

bad condition of the patient. Two instances may be given. In Imbert's case the patient died two days after the operation from cachexia; in one of Maucilaire's cases the patient was 72 years of age, and the artery was found to be filled with clot at the point of section and a probe was passed up into the external iliac in the attempt to clear the lumen of the artery.

Wieting, after whom the operation is usually called in Germany, although San Martin y. Satrustegui was the first surgeon to perform arteriovenous anastomosis for gangrene in man, has laid down very clearly the indications for the operation. They are as follows:

TABLE OF CASES OF ACTUAL GANGRENE OF THE FOOT TREATED BY ARTERIOVENOUS ANASTOMOSIS.

Name of Surgeon	Sex	Age	Type of anastomosis	Result
San Martin y Satrustegui ¹	M.	52	Lateral. Combined with amputation of gangrenous part of foot	Immediate result good, but on 6th day reappearance of pain. Amputation at seat of election and latter through thigh. Death on the 13th day.
San Martin y Satrustegui ¹	M.	76	Lateral. Combined with Syme's amputation	Disappearance of pain. Patient discharged cured.
Hubbard ⁷	M.	80	End-to-end. Invagination of artery	Gangrene spread over foot and then line of demarcation formed. Pulsation in saphenous vein below anastomosis. A month later amputation at seat of election. Tibial arteries found to contain arterial blood.
Hubbard ⁸	F.	60	End-to-end. Invagination of artery	Spread of gangrene. Amputation through thigh 10 days later. Anastomosed vessels found filled with loose clot.
Hubbard ⁹	F.	84	End-to-end	Limb became warm and slightly oedematous. One month later spread of gangrene and death 2 months after operation.
Lilienthal ¹⁰	M.	20	End-to-end	Marked post-operative collapse and death 31 hours after the operation.
Tuffier ¹¹	M.	56	Lateral	No improvement; death on the 8th day.
Tuffier ¹²	M.	50	End-to-end	Pulsation of veins over instep for first 2 days after operation. Disappearance of pulsation thought to be due to thrombosis from slight wound infection. Patient left hospital in a satisfactory condition.
Ballance ¹³	F.	75	End-to-end	Pulsation felt same evening in dorsal veins of foot and internal saphenous. Line of demarcation of gangrene and no return of symptoms. Death 5 months after from acute gangrene of intestines. Complete cicatrization of anastomosis found post mortem.

Name of Surgeon	Sex	Age	Type of anastomosis	Result
Orhan ¹⁴			End-to-side. Intubation of artery	Spread of gangrene; later line of demarcation between middle and upper third of leg. Amputation. Recent thrombosis of popliteal vein found.
Jaboulay ^{16 16}	M.	47	End-to-end	Slight improvement, but amputation through lower third of leg 7 days later on account of pain and rise of temperature. No bleeding from arteries; thrombosis of internal saphenous vein. Pulmonary embolus and death 19 days after first operation.
Jaboulay ¹⁶	M.	66	End-to-end	Spread of gangrene necessitating amputation above site of anastomosis on 5th day. Anastomosis contracted but permeable.
Jaboulay ¹⁶	M.	67	End-to-end	Spread of gangrene and amputation 4 days later. Death on 6th day. Femoral vein found obliterated by clot which extended up into central end of artery.
Lund ¹⁷	M.	32	End-to-end	No improvement. Amputation through foot and later at seat of election.
Armour and Smith ¹⁸	M.	69	End-to-end	General improvement; line of demarcation on 4th day. On 14th day amputation above knee. The vein pulsated at the point of division in the flap, but the artery was occluded.
Abalos ¹⁹	M.	62	Lateral, between femoral artery and saphenous vein	Loss of pain and improvement for 10 days. Pulsation in internal saphenous vein. Then exacerbation of gangrene and amputation through upper third of thigh. Femoral artery and saphenous vein filled with clot.
Imbert ²⁰	M.		End-to-side. Intubation of saphenous vein into side of femoral artery	Two days later death from cachexia. Anastomosis examined, opening small but patent.
Celesia ²¹	F.	52	Lateral	Pulsation in veins below anastomosis on same day, but none the following day. General improvement of foot. On 6th day slight suppuration in wound. Pain in hip on 9th day; abscess opened on 22d day, followed by death. Anastomosis found to be patent.
Tietze ²²	F.	69	End-to-side. Invagination of artery	Spread of gangrene and death from cachexia. The artery was found to be narrowed and the vein thrombosed.
Goldenberg ²³	M.	64	End-to-side. Invagination of artery	General improvement. Reappearance of pulsation in popliteal space, but death from erysipelas on 15th day.
Schmieden ²⁴	F.	48	End-to-end	Return of color to foot, but death next day from heart-failure.
Muller ²⁵	M.	51	End-to-end	Spread of gangrene and appearance of line of demarcation on 3rd day. Amputation refused at first, but done 6 weeks later. Posterior tibial and peroneal veins showed slight spurts of blood; arteries thrombosed. Death 8 weeks after anastomosis.

Name of Surgeon	Sex	Age	Type of anastomosis	Result
Enderlen ²⁶			End-to-end	Circulation restored temporarily, then spread of gangrene and amputation. Artery and vein extensively thrombosed.
Enderlen ²⁶			End-to-end	Improvement during the first 24 hours, but death on the 3rd day. Extensive thrombosis of vein.
Krüger ²⁷	F.	48	End-to-side. Intubation of artery	Spread of gangrene. Pirogoff's amputation on 10th day and Gritti's on 18th. Both artery and vein thrombosed.
Payr ²⁸	M.	70	End-to-side. Intubation of artery	Good result for 10 days, then spread of gangrene and death on 16th day from heart-failure and oedema of the lungs.
Coenen and Wiewiorski ²⁹	M.	51	End-to-end	During operation clot found in femoral artery and removed. Spread of gangrene. Amputation through middle of thigh.
Mauclaire ³⁰	F.	73	End-to-end	No improvement. Amputation at seat of election on 8th day. Amputation through thigh a fortnight later followed by death from cachexia.
Mauclaire ³⁰	M.	72	End-to-end	Artery filled with clot at point of section. Probe passed into external iliac in attempt to dislodge clot, but blood only trickled through artery; anastomosis, however, done. Death on 8th day.
Krause (Quénu) ³¹ ..			End-to-end	Progress of gangrene. Amputation at seat of election 4 months later; blood spurted from tibial vein. Internal saphenous vein injected; injection spread to limits of gangrene; behind the internal malleolus a tributary of the posterior tibial vein joining the internal saphenous was well injected. The anterior and posterior tibial arteries and the peroneal were not injected.
Orhan ^{*32}	M.	40	End-to-side. Intubation of artery. Combined with Chopart's amputation	Healing slow, amputation through lower third of leg.
Wieting ³²	M.	33	Lateral. Combined with removal of gangrenous toe	Improvement slow. Erysipelas 11 weeks after operation necessitating disarticulation through knee-joint.
Wieting ³²	M.	32	Lateral	The gangrene in this case was of a very chronic nature and the 4th toe had already separated, leaving a gangrenous stump. Discharged healed in 5 weeks.
Wieting ³²	M.	35	End-to-side. Intubation of artery	Chopart's amputation necessary 24 hours later; wound healthy and healing on 14th day.
Glasstein ³³	M.	38	End-to-end	Patient left the hospital 3 months later. The gangrene and pain had disappeared and the limb was a good color.
Morrison Davies.	M.	46	End-to-end	Disappearance of gangrene and return of warmth and natural color to the foot with complete freedom from pain. Patient commenced walking on the 28th day and left the hospital at the end of the 8th week. Four months later he was still quite well.

* At the end of the same year Wieting did an arteriovenous anastomosis on the opposite lower limb of this patient for threatening gangrene of the foot.

All other forms of conservative treatment must have been attempted first. The condition of nutrition of the patient must be good. Infection, if present, must not be extensive. Edema must readily subside on raising the foot so as to prove that the venous circulation is sound. The most favorable cases are those in which the gangrene is only threatening. Pulsation must necessarily be present in the femoral artery, and the femoral vein must be free from thrombosis.³⁴

Wieting has himself done the operation five times: three times for actual and twice for threatening gangrene. In one case high amputation was necessary owing to the development of erysipelas nearly 11 weeks after the anastomosis, and in another case Chopart's amputation was done. The remaining three patients were discharged greatly improved—a striking testimony of the value of the operation in properly selected cases.

AUTHOR'S CASE.—The patient is a man aged forty-six, a publican. He has had syphilis and has been a free drinker.

He had suffered from pain and had noticed the progressive discoloration of the middle toe of the left foot since March, 1911.

His condition on admission to the hospital on June 21, 1911, was as follows: The terminal half of the middle toe of the left foot was black and shrivelled, and was marked off from the more healthy tissues by a commencing line of demarcation. No pulsation could be felt in the anterior or posterior tibial or popliteal arteries on either side. Immediately after admission the patient had an attack of delirium tremens.

On July 3, the gangrenous toe was removed by a circular incision round the base; the wound was plugged and left open.

At the beginning of August, when the patient came under my care, the wound was healing but the foot was cold and painful, and there were areas of bluish-red discoloration on the dorsum. By August 13 two small patches of gangrene had developed on the foot, one on the outer side of the second and one on the inner side of the fourth toe. The discoloration of the foot had increased, while the whole of the great toe and adjoining part of the foot, and the skin over the fifth metatarsal

and over the dorsum' were dark bluish-grey with red patches. The amputation wound was granulating slowly.

The femoral artery was easily felt pulsating in Scarpa's triangle, but no pulsation could be made out elsewhere in the limb. The right foot was cold but not painful, and the condition of the vessels on this side was the same as on the left.

There was some hypertrophy of the heart, a trace of albumin in the urine, and the blood-pressure was 220 mm. of mercury.

Both lower limbs were rendered bloodless by elastic bandages; on removing these after a few minutes the reactive hyperæmia was very slight and on neither side spread more than four inches below the knee.

Operation August 15, 1911: Incision five inches long over the sartorius muscle of the left thigh, the mid-point of the incision corresponding to the apex of Scarpa's triangle. The sartorius muscle was drawn outward and the fascia over Hunter's canal divided. The superficial femoral artery and vein were exposed for a length of three inches, dissected free from each other and from the surrounding tissues. Only one small branch of the artery and one tributary of the vein had to be divided. A clamp protected by rubber tubing was placed on the central end of the artery and another on the distal end of the vein; the central end of the vein and the distal end of the artery were ligatured. The artery and vein were then cut across at right angles to the lumen, but the point of section of the artery was 1.5 cm. lower than that of the vein so as to ensure the complete absence of all tension on the vessels when united. The cut section of the vein showed no abnormality, but that of the artery was rigid, calcareous, and brittle. A loop of fine catgut was tied with a half knot round the vessels 0.5 cm. beyond the divided ends. The edges of the artery and vein were then sutured together by means of a series of mattress stitches tied over the catgut so as to evert the coats of the vessels and bring the intima of each into apposition. For these mattress sutures the finest round curved needles and the finest silk soaked in sterilized olive oil were used. The clamp on the vein was removed first and the blood flowed past the juncture as far as the clamp on the artery and no oozing occurred from the anastomosis, but when the clamp on the artery was taken off blood escaped from one point; this was completely con-

trolled by a stitch passing through the everted margins of the vessels. The vein was now seen to be distended and pulsating with the artery. At the end of a few minutes, as the wound remained perfectly dry it was stitched up. Healing by first intention without any indication of oozing from the anastomosis.

The anæsthetic used was scopolamine, morphine, atropine, and spinal analgesia with glucose stovaine. When the anastomosis was half completed the patient complained of pain in the wound and ether was then given by the open method. Duration of operation one and one-quarter hours.

The progress of the case after the operation was perfectly straightforward. On the next day the foot was warm and painless and the discolored areas less obvious. There was no œdema. Doubtful pulsation was felt over the posterior tibial vessels at the level of the internal malleolus. No distention or pulsation of the superficial veins. On August 18 there was pulsation over the popliteal vessels and over both anterior and posterior tibials. After this date, however, pulsation was never again felt below the femoral artery in Scarpa's triangle.

On August 29 general massage of the leg was started. The gangrenous patches on the toes had separated and the original amputation wound was almost healed. The areas of discoloration on the foot and toes had practically disappeared.

The patient started walking four weeks after the operation; neither pain nor œdema was produced by this exercise. He was discharged on October 16.

The patient was readmitted to the hospital under Sir John Rose Bradford on October 21 suffering from aphasia and right-sided hemiplegia of gradual onset. It was thought that the condition was due to a cerebral thrombosis and had no connection whatever with the arteriovenous anastomosis. The patient made a rapid recovery and was discharged on November 25. The circulation in the left foot at that time was perfectly satisfactory and except for the absence of the middle toe the foot had all the appearances of a normal one.

Since this paper was sent to press I have again (Feb. 21, 1912, over six months since the operation) seen the patient. Although he has had a chilblain on the left great toe, the whole foot is warm, normal in color, and painless, and the patient can walk with comfort.

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FRACTURE OF THE RADIUS ABOVE THE ATTACHMENT OF THE PRONATOR QUADRATUS MUSCLE.*

BY EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA

Demonstrator of Fracture Dressings, Jefferson Medical College and Woman's Medical College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

IN reviewing the writings of the old surgeons, one is filled with admiration for their great work in the treatment of fractures. Their knowledge of the causes, deformities, action of muscles, manner of reduction and keeping reduced was truly remarkable. If these men could have had that valuable aid, the X-ray, in studying and treating their fractures, I am sure they would have handed down to the surgeons of to-day methods far in advance of those now in vogue.

In presenting this paper with accompanying X-ray plates, I hope to show that good approximation can often be obtained, if one will but persist and not be too hasty to resort to operative measures.

The following case is a fairly typical one of a fracture in this region. The patient was admitted to the Episcopal Hospital, to the service of Dr. H. C. Deaver, to whom I am indebted for the privilege of treating and reporting the case.

CASE I.—W. D., male, aged forty-one years. Ten days before admission, while at work, patient fell eight feet and as the result of direct force sustained a comminuted fracture of the radius above the attachment of the pronator quadratus muscle.

The attending physician, failing to get good approximation of the fragments, referred the case to the Episcopal Hospital for an operation.

The first X-ray showed the upper fragment abducted and

* Read before the Philadelphia Academy of Surgery, February 5, 1912.

rotated outward and the lower fragment strongly pulled over toward the ulna.

The patient had been under the care of a very skilful physician, who had first treated the fracture in the usual semipronated position, with long palmar and short dorsal splints, and later on a Bond splint, without gaining a good approximation of the fragments.

We had made an internal angular splint (Fig. 1), somewhat pistol shaped at the wrist, so as to strongly adduct the hand, hoping through the action of the external lateral ligament, and possibly the cartilage and the carpal bones, to pull or force the lower fragment in position.

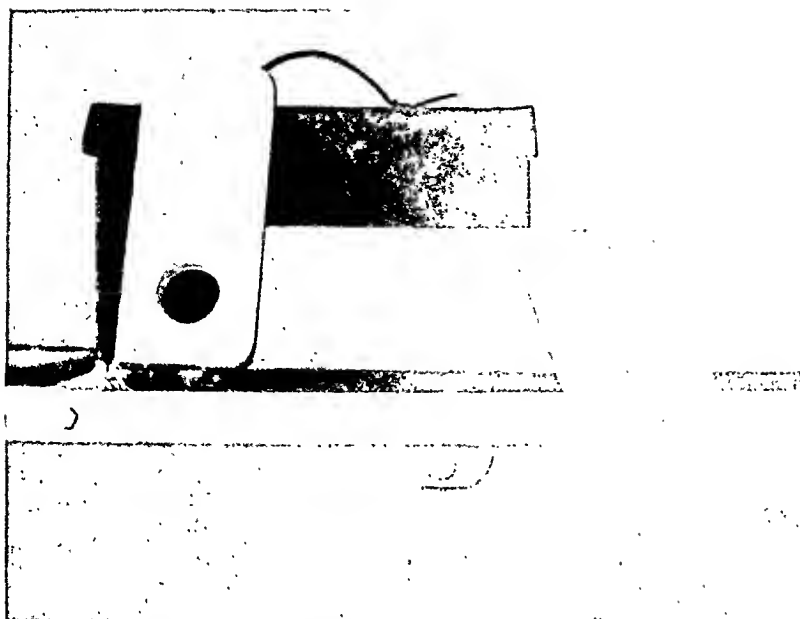
The X-ray of the bones in this position showed that our efforts had not been entirely successful (Fig. 2). The failure seemed to be due to the upper fragment, as this was not affected by the position or adduction of the hand. As the lower fragment seemed to occupy almost a normal position, our efforts at reduction were next directed to the upper fragment.

To overcome its deformity, the arm was placed on an anterior angular splint, likewise pistol shaped at the wrist (Fig. 3), and as in the previous dressing a short straight splint was applied posteriorly from the elbow to the wrist (Fig. 4). This changed the arm from a semipronated to a supinated position and relaxed the flexors of the forearm, thus producing one of the fundamental principles in the treatment of any fracture, muscular relaxation. It also supinated the lower fragment of the radius, bringing it in apposition to the upper fragment. The X-ray of the fracture in this position showed the bones to be in perfect alignment (Fig. 5). Fig. 6 shows end result.

As some difficulty had been encountered in gaining this approximation, and as the fracture had been frequently disturbed during the ten days prior to admission to the hospital, and as there was no attempt at union, the splints were left on for twelve days. During these twelve days the bandages were frequently removed, without disturbing the splints, which were held in place by adhesive plaster, the soft parts inspected and bathed with alcohol, and gentle passive motion given the fingers.

I believe this was unnecessarily long to keep the hand adducted, as a few days in this position would have been sufficient. At the expiration of the twelve days a short straight posterior

FIG. 1.



Internal angular splint to secure adduction of hand

FIG. 2.



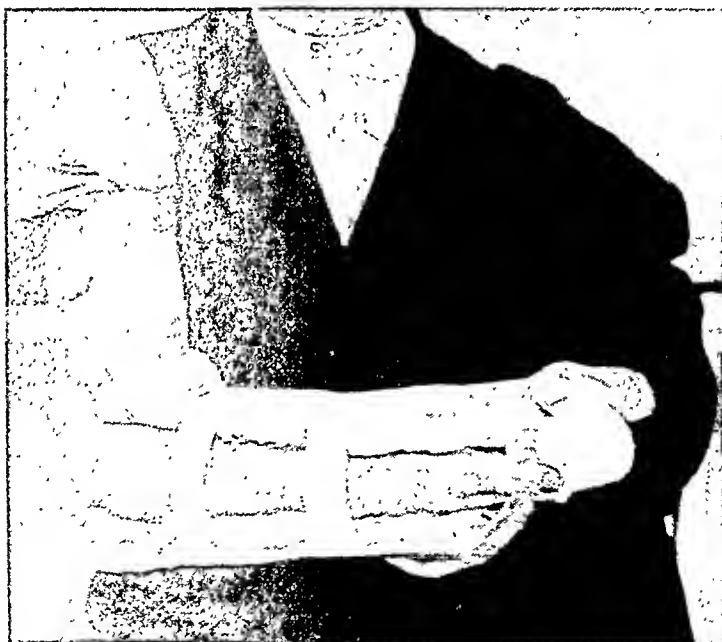
Arm on internal angular splint, pistol shaped at wrist; hand strongly adducted; deformity much improved.

FIG. 3.



Anterior angular splint to procure adduction of hand.

FIG. 4.



Position of arm as shown in X-ray plate (Fig. 5).

FIG. 5.



Arm on anterior angular splint, pistol shaped at wrist; hand adducted; perfect alignment.

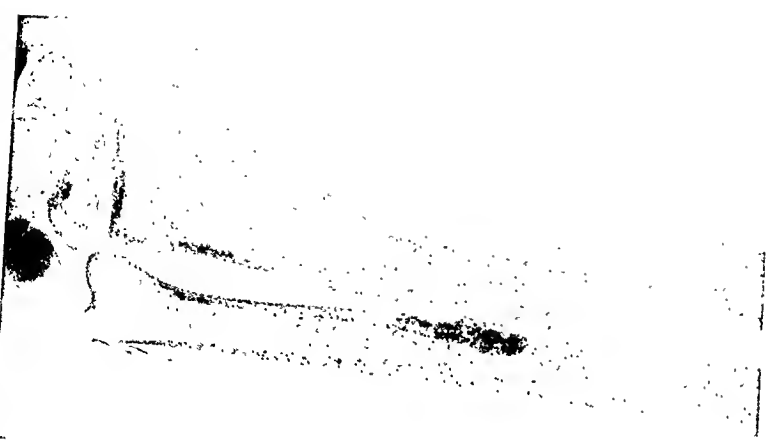
FIG. 6.



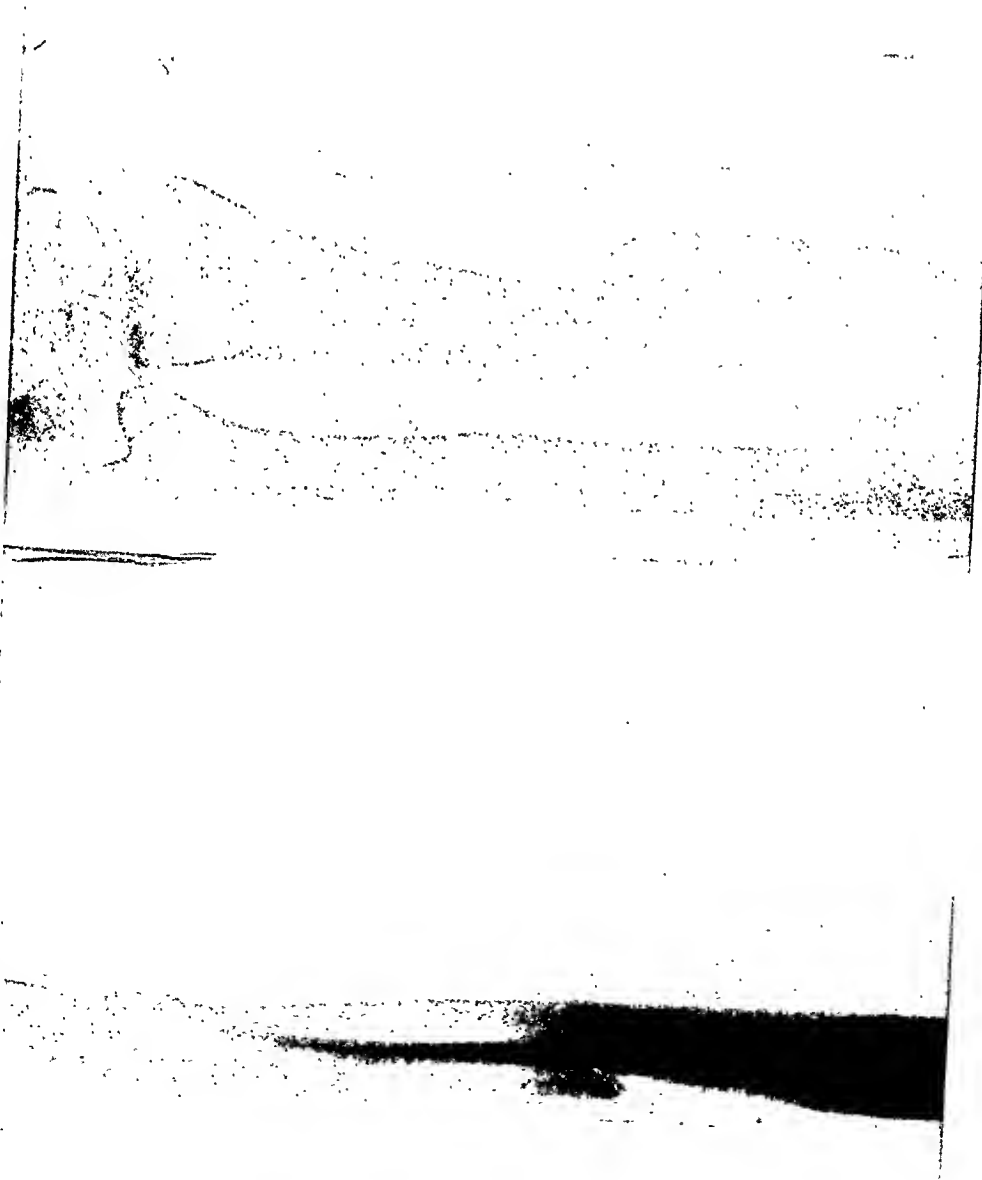
End result of Fig. 2.

Fig. 8.

Fig. 8.



Fracture of radius with typical deformity.



Deformity slightly corrected by interosseous padded splint; intolerable to patient; produced pressure ulcer

FIG. 9.



Arm semipronated; hand adducted; upper fragment tilted forward by action of biceps.

splint, combined with an anterior angular splint, straight at the wrist, was applied. This latter splint should be substituted as soon as possible, as it places the hand in a more comfortable position and minimizes the chances of a stiff wrist.

The method sometimes used of treating fractures of the forearm in a semi-pronated position with a small interosseous padded splint to force the fragments apart is a dangerous one, as so much force is required that pressure ulceration is apt to occur.

Caswell, in referring to this manner of treatment, says: "If useful, intolerable; if tolerable, useless."¹

In a previous case (Fig. 7) of fracture of the radius above the pronator quadratus, an interosseous padded splint was used, correcting to a slight degree the deformity (Fig. 8). This treatment was discontinued, as the interosseous splint produced superficial ulceration. Later the arm was placed on an internal angular splint, pistol shaped at the wrist, to strongly adduct the hand (Fig. 9). This position produced almost a perfect approximation, except for the upper fragment, which was tilted forward by the action of the biceps.

In treating this fracture, not only should one try to get perfect alignment, but also, as Lansdale urged, "keep the fragments in their normal position as to their axis."²

Nélaton, in speaking of fractures of the lower end of the radius, says that Dupuytren laid great stress on the importance of overcoming radial displacement of the lower fragment. He used palmar and dorsal splints, as for fracture of both bones, and after they were applied added along the ulnar border of the forearm and hand an iron band, bent on the flat at the wrist, so as to draw the hand strongly to the ulnar side by means of tension on the external lateral ligament of the wrist.³

Amesbury, in speaking of fractures of the base of the radius, says not to allow the splint along the ulnar border to extend lower than the wrist. He says: "The hand should be suffered to drop as low as possible before it is confined to the

flat part of the back of the splint." "If the hand be confined down in this way it will act as a lever upon the carpal portion of the radius and tend to raise it."⁴

Lansdale, after describing Dupuytren's splint to secure adduction of the hand in fractures of the lower part of the shaft of the radius, says: "When the position of extreme supination is employed, neither the radial nor the ulnar splint is necessary, for then the portions of bone have not the same disposition to fall toward the ulna."⁵

According to Packard, Nélaton's dorsal splint for securing adduction of the hand was originally described by Goyrand in 1836.⁶

I wish to thank the radiographers of the Episcopal Hospital, Dr. T. S. Stewart and his assistant, Dr. A. R. Wilkinson, for the many excellent X-rays of these fractures.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held at Bellevue Hospital, February 28, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

FRACTURE OF THE SURGICAL NECK OF THE HUMERUS TREATED WITH LANE'S PLATES.

DR. JOHN B. WALKER presented a boy, aged 16 years, who sustained a fracture of the surgical neck of the humerus for which, immediately after the accident, a Velpeau and modified Sayre bandage with an axillary pad was applied. A radiograph showed the head rotated outward and upward, with marked inward displacement of the upper end of the lower fragment. Reduction was impossible; 14 days after the accident the fracture was exposed by incision; the fragments were brought into perfect position, and retained by a three-hole Lane plate. A plaster bandage was applied, which included the shoulder and elbow. On the fourth day the patient was out of bed. On the fourteenth day the bandages were removed, and primary union was found present. Massage and active movements were begun. Six weeks after the operation, he was able to work. Eight weeks after the operation he could abduct the arm to normal position, and there was only a slight limitation to external rotation.

OPERATIVE TREATMENT OF FRACTURE OF THE FEMUR.

DR. WALKER also presented four cases of fracture of the femur in which the result of ordinary methods of treatment not having been satisfactory, he had exposed in each the fracture by incision, had overcome the shortening, brought the fragments into perfect alignment, and applied a Lane plate to maintain the position. A most satisfactory result had followed in each case.

DR. JOHN A. HARTWELL said the subject of plating fractures as universally as it was being done, not only in New York but

throughout the country, was well worthy of discussion. The impression seemed to have gotten abroad that plating fractures of the femur was a safe and simple procedure. Personally, he had had one experience with the operation which proved that it was a very serious one. The case was that of a man with a recent fracture of the lower third of the femur with an inch and a half or two inches of shortening; all efforts to reduce it failed, and on the sixth day an open operation with plating was done under every possible precaution, but in spite of this infection occurred, and the man was confined to the hospital with suppuration and necrosis of the femur for ten months, and when he finally left there was still an inch and a half shortening. Such an experience, of course, was exceptional, but Dr. Hartwell said he knew of other cases where the results were almost as bad. He had also seen cases where a slight degree of infection had followed the open operation, requiring the removal of the plates, and he expressed the view that where one was dealing with so serious a possibility as an infection of the femur, one should think twice before subjecting a patient to such an operation. In the abdominal cavity, the peritoneum could take care of a certain amount of infection, but infections about the femur were very serious—more so than in many other regions of the body.

While the literature on this subject abounded with innumerable cases of the splendid results following the insertion of the Lane plates and other open methods, the reports to the contrary were very scarce. Personally, Dr. Hartwell said, he knew of four cases where an amputation became necessary after the open treatment of fractures.

DR. WILLIAM A. DOWNES said he had seen one case of amputation and death following the treatment of a fracture of the femur in the upper third by Lane's plates, in a fat man of 62. In that case the fracture was first treated several weeks by the usual extension methods, then a plaster case was applied, and finally, in a last effort to maintain reduction, the fragments were plated. In about three weeks the wound began to show evidences of infection and the plates were removed. Amputation became imperative, and death finally occurred.

DR. WOOLSEY said he does not resort to the use of the Lane plates unless other means of treatment have failed. The speaker said he had seen a number of cases where a mild grade of infection followed the use of the plates, but he had never had

an infection severe enough to cause necrosis of the bone or to interfere with union.

DR. WILLIAM DARRACH said he agreed with Dr. Woolsey, that the plates should not be used unless other methods had failed and it became absolutely imperative. In the treatment of any form of fracture, the simpler the method of treatment employed, the better, and any case where satisfactory reduction could be obtained should be treated by the closed method. Where satisfactory reduction was impossible, the fragments should be exposed, but as little foreign material used in the wound as possible.

Thus far, Dr. Darrach said, he had treated 99 cases of fracture by the open method, and in 16 of these he had used the plates.

DR. CHARLES L. GIBSON said he was glad to hear the remarks of Dr. Hartwell and the other speakers on this subject, and personally he did not believe that the impression should go forth from the New York Surgical Society that the treatment of fractures should preferably be by the open method.

Dr. Gibson said he now had under his observation a man who was treated at Bellevue Hospital within the past 18 months for a fracture through the upper fourth of the femur. The plating operation had been done, and from the nature of the fracture in that case it was apparently justified, but the results, as shown to-day, were very bad—in fact, they could not have been worse without any treatment. In spite of his disability he had been able to get about pretty well, until he recently sustained a fracture of the opposite leg.

DR. WALKER said he had done the open operation in 19 cases of fracture of the femur, and in none of them did any serious results follow. In all of these cases, other methods of reduction had first been tried. (He had been compelled to take out the plates because of infection.) By means of the Lemon fracture-reducing apparatus which he demonstrated, he had been able to secure reduction in cases that were otherwise irreducible. The speaker said he did not limit the use of this apparatus to cases where an open operation was indicated.

GIMLET AND BAR METHOD OF OPEN OPERATION IN FRACTURES.

DR. HOWARD LILIENTHAL presented the following cases to illustrate his method of open operation in fractures:

CASE I.—*Fracture of the femur:* The patient was a laborer,

23 years old, who was admitted to Bellevue Hospital on September 7, 1911, with a fracture of the femur at the junction of the middle and lower thirds. A skiagram showed a transverse fracture of the bone, with spicules projecting upward and downward, and with the lower fragment over-riding the upper by more than an inch.

Operation, September 14, 1911: In order to maintain constant traction on the limb, and if possible overcome the over-riding after the exposure of the fragments, a Buck's extension was applied in the following manner: Instead of using strips of mole-skin plaster, Dr. Lilienthal applied a loop of wet cotton flannel reaching from above the knee down and around the foot and above the knee on the other side; this was firmly held in position with a moistened cotton flannel bandage, and nearly 100 pounds of traction applied.

The fracture was then exposed through an eight-inch antero-external incision, splitting the quadriceps fibres. Upon inspection it was found that the traction had scarcely affected the over-riding, and the lower fragment was displaced outside the upper. After chiselling away the projecting spicules, the two ends of the bone were brought into as perfect alignment as possible, and a single gimlet screwed into the bone near the end of each fragment. Before the gimlet could be used, it was necessary to drill a small hole into the bone, because of its hardness. Into each of these drill-holes made near the ends of the fragments, an ordinary gimlet was inserted and left *in situ*. A small steel bar was then inserted between the gimlet heads, and a plaster bandage carried around the bar and gimlets to secure fixation. The wound was then packed and a dry dressing applied, together with a long external splint reaching to the axilla and a right-angled foot-piece.

A skiagram, taken two days after the operation, showed that the ends of the fragments were in poor alignment, and Dr. Lilienthal decided to make a second attempt to reduce and fix them. Accordingly, on September 19, he removed the packing and withdrew the gimlets. Then, while an assistant made traction and produced the proper motions, he finally succeeded in getting the ends of the bone into apposition. Four gimlets were then inserted, two in each fragment, the steel bars placed between the gimlet-heads, and after fixing these with a plaster-of-Paris bandage, the wound was dressed as before.

On October 5 the wound was inspected, and the gimlets and packings removed. For some days following the operation, the patient had a slight temperature, going up as high as 101° F., when it gradually subsided to normal. A plaster spica was applied. At the present time, the right extremity was one-eighth of an inch shorter than the left and function was excellent, though the muscular adhesions still somewhat limited the motion at the knee.

CASE II.—*Compound fracture of the tibia and fibula:* The patient was an iron worker, 42 years old, who was admitted to Bellevue Hospital on August 3, 1911, after having fallen four feet from a ladder. Examination revealed a fracture of both bones of the left leg about two inches above the ankle, with the lower end of the upper fibular fragment protruding through the skin for an inch and a half. The wound bled freely, and the foot was adducted. An attempt was made to reduce the fragment, and a temporary dressing was applied. A skiagraph showed the reduction to be unsatisfactory, and Dr. Lilienthal decided to operate.

With the patient under ether an attempt at reduction was made, but it was also unsuccessful. A six-inch incision was then made over the lower end of the tibia so as to expose the fracture line. It was found that the lower fragment of the tibia had been displaced to the fibular side of the upper fragment, but by manipulation of the foot and the use of a bone hook he was able to bring it into proper alignment. He then screwed two gimlets into the anterior surface of each tibial fragment, and crossed two short steel rods between their heads, thus fixing the gimlets and, through them, the fragments by means of a plaster bandage passed around the heads of the gimlets and the interplated rods. The wound was left open and a dry dressing applied, and a posterior and two lateral splints were applied to the leg.

On August 31, 1911, the gimlets were removed, and the packing, which was found clean and fresh, was changed. The patient made an afebrile recovery, and on September 30, when the wound had healed, a plaster case was applied to the leg. He left the hospital on the following day, to return later for the removal of the case. As presented to the Society this patient walked well, but there was still some stiffness at the ankle.

Dr. Lilienthal said the method he had employed in these two cases was a modification of the method first described by Dr.

Leonard Freeman, of Denver, for treatment of fractures of the tibia and afterwards fully reported in the *Transactions of the American Surgical Association*, vol. xxix, by which Dr. Freeman sought to overcome the necessity, in treating fractures by the open operation, of putting in an apparatus which would have to be subsequently removed. His method, essentially, was to insert four drills into the bone, which were left protruding beyond the skin for a considerable distance, and which were held in place by two steel bars of suitable shape and kept parallel by means of clamps. After the lapse of a certain period of time, the bar was taken off and the drills removed. Dr. Taylor, of Port Arthur, had modified this method by substituting plaster-of-Paris fixation for the clamp, and Dr. Lilienthal said he had further modified it by substituting ordinary gimlets for the drills and by applying the method to other bones than the tibia. In inserting these gimlets into the bone, no attention was paid to the alignment of the fragments. After their insertion, however, an effort should be made to get the fragments into perfect apposition and then keep them so by inserting a steel bar between the gimlet-heads and making the fixation permanent by imbedding the bars and gimlet-heads in a plaster-of-Paris bandage. The wound was then treated as an open fracture, or it could be closed by strips of adhesive plaster, and in the course of two or three weeks the gimlets were usually sufficiently loosened to be taken out without pain to the patient or danger of recurring deformity.

Dr. Lilienthal said that while he would not give preference to this method over the use of the Lane plates in cases of simple fracture, he was strongly in favor of it in dealing with open or infected fractures. By this method, there was less danger of the occurrence of a diffuse osteomyelitis or suppuration in the deeper tissues. There was free drainage, and if an osteomyelitis or suppuration did occur, it would take care of itself. He believed that the method possessed enormous advantages over the use of the Lane plates or wire in cases where there was an open fracture or where infection was present.

CHRONIC ULCER, WITH CARCINOMA OF THE STOMACH: GASTRECTOMY.

DR. GEORGE WOOLSEY presented a woman, 32 years old, who was admitted to Bellevue Hospital on December 22, 1911. She gave a positive venereal history. She had a miscarriage 14 years

ago, and about the same time she had an oöphorectomy done; since then her menstruation had been irregular, coming on at intervals of from two to four months. A year ago she was operated on at the Post-Graduate Hospital for exophthalmic goitre. There had been considerable loss of weight during the past three months.

The patient's present illness began about a year ago, when she had a slight attack of indigestion. During the past three months she had vomited from time to time, and two weeks ago she had a severe attack of vomiting, with some epigastric pain, which kept her in bed for two days. The vomitus was usually light brown in color, but contained no blood. On December 22, 1911, after she had eaten practically nothing, she became dizzy and lost consciousness, and after recovering from this she vomited a large quantity of bright blood and numerous large clots. There had been no pain before this attack, only anorexia. There had always been more or less tenderness over the epigastrium, especially in the last two weeks. On December 30 the patient was put on a Lenhartz diet, but she frequently vomited and felt distended, and on two occasions she had a definite hæmatemesis, with coffee-ground vomitus and clots. The stools were dark. The urine contained a trace of albumin and a few leucocytes and pus-cells. The Wassermann was weakly positive. A blood count, made on December 28, showed 11,400 leucocytes, with 3,760,000 red cells and 35 per cent. of hæmoglobin. A week later there were 15,000 leucocytes, with 3,550,000 red cells and 38 per cent. of hæmoglobin.

Operation, January 7, 1912: Upon exposing the stomach, a large indurated mass was found upon the antero-inferior aspect of the pyloric portion of the stomach. No enlarged glands could be made out. A partial gastrectomy was done, together with a posterior gastrojejunostomy. The post-operative course was practically uneventful, and when the patient was discharged, on February 3, 1912, she was able to eat almost any kind of plain food, and had no symptoms referable to the stomach.

The pathologist reported that the specimen showed a colloid carcinoma implanted upon a gastric ulcer. The extreme vascular changes and the presence of what seemed to be small gummata suggested a luetic process.

The points of interest in the case were (1) the absence of the typical hunger pains, relieved by eating, vomiting, etc., in fact of almost any pain; (2) the commencing carcinoma on the base

of an old ulcer. This is the second case among the last three calloused ulcers removed by pylorotomy that has showed commencing carcinoma.

The Lenhartz diet was not well borne, either before or after operation. During the latter period it was found that if the eggs were omitted the milk and cream were well taken.

CARCINOMA OF THE STOMACH: PARTIAL GASTRECTOMY WITH POSTERIOR GASTROJEJUNOSTOMY.

DR. WOOLSEY presented a man, 41 years old, who was admitted to Bellevue Hospital on January 25, 1912. He had typhoid fever about 20 years ago. Denied lues. He had been constipated during the past year. Nine months ago he first began to experience pain in the epigastric region, coming on about half an hour after taking food. He would then vomit and feel relieved, the vomitus always being very sour. No blood had been noticed in the vomitus or stools. There was no history of vomiting for about six weeks prior to his admission. During his illness he had lost 50 pounds in weight and felt very weak.

Examination revealed tenderness in the epigastrium, and on deep inspiration a hard, indistinct mass could be felt high up in that region. The liver edge could be felt, but the spleen was not palpable. The urine showed nothing abnormal. A blood count gave 7700 white blood-cells, with 76 per cent. of polymorphonuclears and 37 per cent. of hæmoglobin. The red cells numbered 3,360,000.

Operation, February 2, 1912: Upon exposing the stomach, a mass was found at the pyloric end, about six inches long and two inches in diameter. No enlarged glands were found. A partial gastrectomy was done, with a posterior no-loop gastrojejunostomy. The patient made an uneventful recovery from the operation, and at the present time was eating and feeling well. The pathological diagnosis was colloid adenocarcinoma, with marked adenohyperplasia of the normal wall of the stomach.

FORWARD DISLOCATION OF THE ELBOW, WITH FRACTURE: BONE PLATING.

DR. WOOLSEY presented a man, 42 years old, who was admitted to Bellevue Hospital on January 8, 1912. On that day he had received a blow over the left, flexed elbow, after which he was

unable to move the left arm on account of the pain. An examination showed a contused wound over the base of the left olecranon and extending to the bone. There was a fulness over the lower end of the joint, which was flexed and could not be fully extended. The X-ray showed a fracture through the olecranon, extending from in front backward and downward. The radius and the lower fragment of the ulna were dislocated forward.

On January 12, Dr. Woolsey made a longitudinal incision, two inches long, over the posterior surface of the upper end of the ulna; there was some difficulty in reducing the lower fragment, but this was finally accomplished with the aid of a bone-hook, but when the instrument was removed, the deformity was immediately reproduced, owing to the obliquity of the fracture. Lane plates were thereupon introduced to keep the fragments in apposition.

About a week after the operation the incision broke down and granulated, and an infection of a mild grade occurred. The X-ray at this time showed that the dislocation was reduced, with the fragments in very good position. The patient left the hospital with a small granulating area, but was readmitted on February 12 with a sinus leading down to the plate. Four days later Dr. Woolsey reopened the incision and removed the plates. The wound was resutured, and healed by granulation.

At the present time the patient had fairly good motion, with almost complete extension and flexion to less than a right angle. As yet no massage nor passive motion had been employed. The patient left the hospital on March 7, 1912.

In connection with this case, Dr. Woolsey exhibited the X-ray plates taken before and after operation, the latter showing complete reduction. He called attention to the fact that Stimson, in the Sixth Edition of his book on "Fractures and Dislocations," published in 1910, stated that up to that time the total number of reported cases of this form of injury was less than 25, including seven cases like the present one, where there was a fracture through the upper end of the ulna, the olecranon remaining in position. Most cases were due to a fall on the flexed elbow.

CASES ILLUSTRATING STOMACH AND GALL-BLADDER CONDITIONS.

DR. JOHN A. HARTWELL presented five cases illustrating various phases of the surgery of the stomach and gall-bladder. These cases were grouped together because of the confusion and diffi-

culty in making an accurate diagnosis in this class of lesions, and were selected as examples very commonly met with. Three of the cases were diagnosed as gastric ulcer prior to operation, and in only one of these was an ulcer found, one being a dilated stomach due to gastropptosis and the other being a cholelithiasis. One was diagnosed as cholelithiasis and no lesion was found, unless a kink in the appendix could be so called. The fifth was correctly diagnosed as gastropptosis, but many of the clinical findings here also suggested the possibility of a gastric ulcer. A study of the case histories explained the reasons for the errors in diagnosis, and might be of value in aiding toward their avoidance in the future.

In reporting the two cases of gastropptosis, Dr. Hartwell emphasized the satisfactory results obtained by the "hammock" operation, together with the ease of its performance and the sound surgical principle upon which it rested. He deprecated combining it with gastro-enterostomy unless an actual mechanical obstruction of the pylorus existed which would not be relieved by the correction of the malposition, or unless an actual ulcer could be demonstrated in the pyloric half of the stomach or in the duodenum.

He further said that in some of these cases where this "hammock" operation was done, there had been no recurrence of the condition after two years. Where the whole length of the transverse colon was used, it gave the stomach a pretty strong, wide support; furthermore, with the patient in the upright position it threw the weight of the stomach backward against the spinal column. As further evidence that there was no elongation of this support in the course of time, Dr. Coffey had taken X-ray pictures of the colon after the introduction of bismuth, and these showed the colon in normal position as long as two years after the operation.

THORACIC ANEURISM TREATED WITH GOLD WIRE AND GALVANISM.

DR. WILLIAM C. LUSK read a paper with the above title, for which see page 789.

In connection with this paper Dr. Lusk showed a specimen of an innominate aneurism which had increased in size until it reached to beneath the patient's chin. Dr. Lusk had wired this aneurism four times, and he demonstrated a comparatively limited area of laminated fibrin deposit on the sac-wall, in which

lay embedded an aggregation of loops of wire, and also projecting centrally into the aneurismal cavity from the peripheral mass a further deposit of laminated fibrin supported in the meshes of a snarl of wire. Many centrally located loops of wire presented themselves free from fibrin and untarnished.

A NEW DRESSING FOR SKIN-GRAFTING.

DR. ARTHUR S. VOSBURGH presented a man upon whom skin-grafting was done following the excision of a carbuncle on the back of the neck. The method employed was as follows: The grafts were covered with zinc oxide adhesive plaster which was first sterilized in formalin vapor. These strips of plaster were placed close together, leaving a very small interval between them to allow for the escape of secretion. They were left *in situ* for a period of from six to eight days, the superficial dressings being changed as required.

In commenting upon this method, Dr. Vosburgh said he would not take that time to enter upon a consideration of the phenomenon of cytolysis, which by its presence or absence made for failure or success in all transplanting operations. Certain mechanical principles were important, however, whether one employed the Reverdin, the Thiersch, the Wolfe, or the Krause method. The success of the operation depended primarily on the maintenance of cellular vitality; the grafts must quickly establish nutritional relations with the area covered, and it was obvious that once placed in position, the transplanted skin or epidermis should not be moved. Formerly, the grafts were covered with rubber tissue, silver or gold foil, or wide-meshed tulle rendered non-absorbent with sterile paraffin, and a dry or moist sterile gauze, held in place by bandages, completed the dressing. Later operators found that leaving the grafts exposed to the air gave much better results, and this would be the ideal method were it not for the danger of the grafts becoming dislodged through some movement of the patient, intentional or otherwise. Attempts had been made to protect the grafts with a wire cage or some similar device, but the range of usefulness of this method was limited.

Dr. Vosburgh said that having observed the behavior of epithelium in chronic ulcers that were covered by zinc oxide adhesive plaster, he was led to apply this dressing directly over skin grafts. He had employed the method in a number of cases

during the past year where it seemed impossible or at least improbable that any other form of dressing could be maintained in position, and it had proven successful on the back, the nates, and in regions about joints. The speaker said all observers agreed that the superficial layers of skin grafts were exfoliated, and this often led the uninitiated to fear that the graft had failed. It was the separation of the graft into layers that rendered the success of this method possible.

DR. FRANK S. MATHEWS said he first learned of this method of skin-grafting from Dr. Vosburgh about a year ago, and since that time he had used it successfully in a number of instances. In every case the grafts had taken. In a case in which he used this method 3 weeks ago there were very extensive burns of the face, with complete ectropion of the lower lid. Skin grafts were applied by the method Dr. Vosburgh had described. The grafts took completely on an area where by other methods there would be much likelihood of their slipping. The adhesive kept the grafts flat and in addition splinted the eyelids and corner of the mouth. The adhesive strips were removed only when they loosened themselves, *i.e.*, in six to eight days, at which time the grafts had taken. No further dressing was applied other than covering the exposed area with ointment.

DR. COLLINS said he had used the Beck's paste several times for the purpose of covering skin grafts, but he was not yet prepared to express his opinion regarding its value. He had noted that the application of Beck's paste to the area from which the grafts had been taken resulted in a very rapid repair of the denuded area.

COLLAPSE OF A TRANSFUSION DONOR.

DR. BURTON J. LEE presented a man, 26 years old, who acted as the donor in a case of marked secondary anæmia from gastric hemorrhages in a man of 55. Prior to the operation the donor had a normal blood picture. The recipient had 20 per cent. of hæmoglobin, with some normoblasts and megoblasts present, together with slight distortion of the red cells. The hæmolytic test was satisfactory, and the donor gave a negative Wassermann.

The blood was allowed to run for 50 minutes after the connection had been made by means of an Elsberg cannula. At the beginning, the donor's blood-pressure was 160; during the first 40 minutes it fell to 140, and he looked a trifle pale, but insisted that

he felt all right. During the last ten minutes of the transfusion his blood-pressure fell to below 100, and he went into collapse, with dilated pupils, cold perspiration, and relaxed sphincter urinæ; his extremities were cold, with an almost imperceptible pulse. He was inverted and freely stimulated, and his condition soon improved. He was then put to bed, with the foot of the bed elevated.

Four days after the operation he felt well enough to go to a dance, and said he never felt better in his life. His color was good. A week after the operation, his hæmoglobin was about 90 per cent., and at the final examination, made recently, it was between 80 and 85 per cent. The transfusion was done under cocaine anæsthesia.

Dr. Lee said the points of interest brought up by this case were: (1) How long might a transfusion be continued, and what was a fair index of safety? (2) What was the legal responsibility of the surgeon in such a case, and what steps should be taken to protect oneself? (3) The quite marked improvement of the recipient to date, seven and a half weeks after the operation, his hæmoglobin now ranging between 70 and 80 per cent. The diagnosis of the gastric condition was still in doubt, and an exploratory operation had been advised. The transfusion was done not only with a view to temporarily helping the recipient, but also to place him in such physical condition that an exploratory operation might be safely performed.

DR. LILIENTHAL said the collapse of the donor in the case shown by Dr. Lee might possibly have been due to the effects of the cocaine. As for relieving oneself from legal responsibility in case of a fatality or accident, Dr. Lilienthal said that at the Mt. Sinai Hospital they had a printed release which the patient was requested to sign before operation. While such a release probably had no legal value, patients who signed it were not so apt to sue as might otherwise be the case.

DR. HARTWELL said he thought the collapse of the donor in the case of transfusion reported by Dr. Lee was rather late to be attributed to the effects of the cocaine. Possibly it was due to the long duration of the transfusion. In his own cases, the speaker said, he preferred novocaine to cocaine, and he thought it wise to suspend the transfusion when the blood-pressure dropped, say from 160 to 130 mm. A sudden decided drop in

the blood-pressure should serve as a warning, and in case of collapse the donor should be placed with head low, and given whiskey and coffee *per rectum*.

SUBPHRENIC ABSCESS.

DR. VOSBURGH presented a woman, 38 years old, who was admitted to Bellevue Hospital on September 28, 1911, with the history that a month prior to her admission she began to suffer from a dull, aching pain in the right side, with chilly sensations, fever, and loss of appetite. The pain was aggravated by any movement involving the muscles of the back or flanks, and it sometimes radiated to the iliac regions. She felt most comfortable when lying on the left side, and complained of soreness to the touch over the right lumbar region. There were no symptoms referable to the stomach, liver, or bladder. The patient was becoming progressively worse.

Upon examination of the abdomen, there was rigidity and tenderness over the right flank, as far forward as the anterior axillary line. Over this region, an indefinite, non-movable mass could be made out. It seemed soft and was not definitely defined, extending from under the costal border down near the crest of the ilium. The liver and spleen could not be felt; the appendicular region seemed normal. The patient had a septic temperature, at times going as high as 104° F.

Operation, October 3, 1911: Through an exploratory incision above the crest of the right ilium a mass could be felt extending from the right kidney upward and behind the liver. A second oblique incision was then made in the right lumbar region, and upon incising the fatty capsule of the right kidney, four ounces of thick pus escaped. From this abscess, a narrow, fistulous tract extended upward behind the liver and under the diaphragm. Free drainage was established, and following this the patient's temperature dropped to 99.5°, and remained so until October 22, when she had a chill, and a temperature elevation to 103°. The wound was thereupon explored, but no pockets of pus were discovered. The patient continued to have a daily range of temperature from 99° to 100° until November 23, when it had practically fallen to normal. She left the hospital on December 2, 1911, with a small discharging sinus.

Stated Meeting, held March 13, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

DISAPPEARANCE OF RECURRENT CARCINOMA AFTER
INJECTION OF COLEY'S MIXED TOXINS.

DR. WILLIAM B. COLEY presented an unmarried woman, 39 years old, whose paternal aunt had died of cancer of the breast. The patient had suffered from marked curvature of the spine since early childhood, necessitating the wearing of an aluminum corset which produced constant irritation of the breast. A very small, movable tumor appeared in the left breast, which was removed in the spring of 1905. The clinical diagnosis of fibroadenoma was confirmed by Dr. W. C. Clark, Pathologist of the General Memorial Hospital. There was no evidence of malignancy at that time. Two years later another small nodule appeared in the region of the first, and microscopically this proved to be carcinoma. The entire breast was thereupon removed, but on account of the poor general condition of the patient and the very small size of the tumor, the axilla was not opened and the pectoral muscles were not removed. One year later a similar nodule appeared in the outer portion of the right breast; this was very small when discovered, but harder than the one on the other side. In view of the patient's previous history, the entire breast was removed in February, 1908. A microscopical examination was made by Dr. James Ewing, Professor of Pathology of the Cornell University Medical School, who pronounced the disease to be typical carcinoma.

In December, 1908, the patient again consulted Dr. Coley, and he found a well-marked recurrence in the left pectoral and cervical regions. The case was clearly inoperable. For a few weeks he tried the thyroid preparation of Prof. S. P. Beebe, of the Cornell University Medical School, but as the tumors rapidly increased in size in spite of the treatment, it was discontinued. In February, 1909, there was a hard, carcinomatous mass occupying the entire left pectoral region, with typical carcinomatous involvement of the supraclavicular and cervical glands reaching nearly to the mastoid. He regarded the case as absolutely hope-

less, and gave a prognosis of less than six months of life. Being asked by her family if the toxins offered any hope in such a case, he replied that while they might possibly cause some slight retardation of the growth of the disease, there was no hope of a cure, and he advised against the treatment. In spite of this, her sister was anxious that the treatment should be tried, as she wanted to feel that something was being done.

In order to lessen the discomfort associated with the treatment, due to the local irritation of the injections, Dr. Coley directed her family physician, Dr. W. J. Bott, of Palmyra, N. Y., to use only the filtered toxins, which were about half the strength of the unfiltered and very much less irritating. The patient proved exceedingly susceptible to the toxins, very small doses being sufficient to produce moderately severe reactions. The initial dose was half a minim; this was gradually increased to three minims. Within a few weeks her physician wrote that very marked improvement had occurred, and that the tumors were gradually decreasing in size; the improvement steadily continued, and in August, 1909, Dr. Bott wrote that both the pectoral and cervical tumors had practically disappeared entirely. When Dr. Coley examined the patient on February 24, 1910, he could find no trace of a tumor in either the pectoral or cervical region. The patient had regained her normal health and never felt better. There were no glands in the axillæ and no swelling of the arm. Up to this time she had received 104 injections, the dosage ranging between one-half and three minims, and although she strongly objected to a continuation of the treatment, she was persuaded to go on with it and it was continued, with occasional intervals of rest, up to February, 1911. Her acute susceptibility to the toxins not only persisted but became increased, so that toward the end she was scarcely able to tolerate more than a minim and a half.

Dr. Coley said he had made a preliminary report of this case before the meeting of the American Cancer Research Society last April, but that he had hesitated to present her before the Surgical Society until a period of at least three years had elapsed. She had received 160 injections altogether within a period of two years. Her weight, which had fallen to 80 pounds, was now 100 pounds, as much as she ever weighed in her life. The cachexia which she was then beginning to show had entirely disappeared.

While one could not say, even after the lapse of this period, that the patient was cured, yet Dr. Coley thought the fact that an inoperable, recurrent carcinoma, in which the diagnosis was established beyond any doubt, had entirely disappeared under the mixed toxins, was sufficient to justify him in bringing the patient before this Society. It should be further noted that the result in this case was obtained entirely from systemic injections.

In connection with this case, the speaker referred to two cases of carcinoma of the breast reported by Lageux (*Le Bulletin Médical de Quebec*, June, 1909), in which similarly brilliant results were obtained with the toxins, one patient having remained well nearly five years and the other two and three-quarters years.

Dr. Coley said these cases were of particular interest for the reason that, so far as he knew from his own experience and from a very careful review of the literature, they were the only cases in which an inoperable, recurrent carcinoma, with glandular metastases and with the clinical and microscopical diagnosis unquestioned, had ever disappeared under any mode of treatment, and where the patient had remained well for a period of three years.

Dr. Coley said that while during his early experiments with the living streptococcus of erysipelas he had tried the effect of inoculation upon carcinoma as well as sarcoma, after substituting the mixed toxins of erysipelas and *Bacillus prodigiosus* he had practically limited the method to cases of inoperable sarcoma, believing it wise to first establish its value in this class of cases. Among his earlier cases, however, there was one of inoperable carcinoma of the floor of the mouth, involving the lower jaw, where the diagnosis was confirmed by microscopic examination, in which the disease entirely disappeared and the patient was well at the last observation, six years later.

The speaker said he did not report the above cases as offering sufficient justification for adopting the treatment as a routine method in cases of inoperable carcinoma, as he felt that the percentage of cures would probably be very small. He did feel, however, that these cases justified a further and more thorough systematic study of the toxins in inoperable carcinoma, particularly for the reason that his earlier experiments were carried on with a preparation much inferior to the present product. He further believed that, taken together with the two cases reported by Lageux, they furnished sufficient ground for advocating the

routine adoption of a systematic course of treatment with the toxins after all primary operations for carcinoma. This plan had already been adopted by a number of leading surgeons. The treatment could be easily carried out by the family physician, and did not necessitate any interference with the daily occupation or routine of life of the patient.

Dr. Coley said he did not think sufficient recognition had been given to the clinical observations made as to the result of accidental erysipelas in inoperable malignant tumors of all types. A brief reference to these observations still further justified the conclusion which he had offered. In one of his earlier papers, entitled "The Treatment of Malignant Tumors by Repeated Inoculation of the Living Germ of Erysipelas" (*American Jour. of the Med. Sciences*, May, 1893), he reported 38 cases—17 sarcoma, 17 carcinoma, and 4 in which the type of tumor was not stated—in which an attack of erysipelas had occurred, 23 times as an accidental occurrence and 15 times as the result of inoculation. Of the 17 cases of carcinoma, 3 were permanently cured. One, a probable carcinoma, was well five years after the attack of erysipelas. The remaining 13 showed more or less temporary improvement. Of the 17 cases of sarcoma, 7 were well from one to seven years afterwards; the remaining 10 cases nearly all showed improvement, some disappearing entirely but later recurring. In the *American Jour. of the Med. Sciences*, March, 1906, he published six additional cases of cancer, five epithelioma and one sarcoma, in which an attack of erysipelas had intervened in the course of the disease.

PARALYSIS AGITANS IN ONE ARM FOLLOWING BREAST AMPUTATION.

DR. N. W. GREEN presented a woman, 56 years old, upon whom he had operated three years ago for a tender, growing lump in the right breast. The breast together with the muscles and axillary contents was removed, the wound healing by primary union. The pathological report on the tumor showed it to be fibro-adenoma.

For 18 months after the operation the patient had good use of her arm; then she noticed a beginning coarse tremor in the right hand, which gradually grew worse until now she had great difficulty in using it. She now had a well-marked paralysis agi-

tans confined to the right arm and hand. On intention, the tremor ceased.

Dr. Green said he had brought this case up for discussion, as he believed the condition was unusual after breast amputation, and because he had doubt as to whether the operation was the cause of it.

Dr. ROBERT T. MORRIS said the paralysis agitans in this case might possibly be due to an irritation of the nerves caused by retraction of the scar tissue, or to some of the remote effects of injury to the nerves following the operation. In some instances he had seen joint adhesions which had to be broken up under a local anæsthetic. A French writer had attributed some of these symptoms to injury of the posterior circumflex nerve, resulting in a synovitis with adhesions in the joint. Dr. Morris said that surgeons, he at least, had overlooked the tendency to formation of joint adhesions after amputation of the breast until recently.

Dr. JOHN ROGERS said it was inconceivable to him that any direct connection could exist between the breast amputation and the paralysis agitans as the result of the cicatrization of the wound about the nerve plexus. Paralysis agitans was supposed to be a neurosis, which meant nothing whatever. No pathological changes had been found in these cases, and the condition was usually aggravated by all kinds of organotherapy, which was quite suggestive. The occurrence of paralysis agitans after operation must therefore be a mere coincidence.

RESECTION OF THE RECTUM WITH RETENTION OF SPHINCTER.

Dr. N. W. GREEN presented a man, 43 years old, who was operated on six months ago for carcinoma of the rectum. Two years ago, when Dr. Green had operated on him for an attack of acute appendicitis, he made a rectal examination, which showed nothing abnormal in that section of the gut.

The history of his present trouble, so far as could be ascertained, dated back about two weeks, when he began to suffer from constipation and a constant desire to stool. On examination, a stricture admitting the tip of the index-finger was found, two and a half inches above the anus. A section of this was removed, and upon microscopic examination proved to be gelatinous carcinoma.

As the patient was a man with considerable adipose tissue, and as his family strongly objected to his having an artificial

anus, it was decided to remove the growth by the coccygeal route. This was accomplished with the assistance of Dr. Walton Martin, by splitting the sphincter posteriorly and carrying the incision well up on the sacrum. The sacrococcygeal articulation was divided and the top of the coccyx turned outward, putting the muscular attachment on the stretch. This made it easier to find the proper planes in the dissection. The gut was then divided above the growth and freed anteriorly, the levator ani was cut, and the rectum together with the growth was turned backward, bringing it out behind the sphincter. The lower portion of the rectum was then cut around, and the growth, with about four and a half inches of the rectum, was removed. The proximal portion of the gut was then drawn down and sutured to the mucous membrane just within the sphincter; this was done under considerable tension. The sphincter was then re-united with suture, and a drain placed behind in the hollow of the sacrum. The patient's convalescence was uninterrupted, and he now had full control of his sphincter.

Dr. Green said his reasons for adopting this route in this case were, (1) the fact that the growth was located low down; (2) that the patient was a man; (3) that he was fat; (4) that it was in accordance with the wishes of his family; and (5) that he believed colloid cancer was more apt to recur locally, and less apt to form metastases.

CARCINOMA OF THE RECTUM: COMBINED ABDOMINAL AND PERINEAL RECTECTOMY.

DR. WALTON MARTIN presented a man, 41 years old, who was admitted to St. Luke's Hospital on December 7, 1911, with a carcinoma of the rectum four inches above the sphincter.

On December 11, 1911, under ether anæsthesia, with the patient in the Trendelenburg position, the abdomen was opened in the median line. The sigmoid colon was clamped at its lower portion, and the gut crushed, tied, and divided with the cautery. The stumps were then invaginated and closed with a purse-string suture, as in appendectomy. The proximal end was brought out through an intermuscular incision on the left side; the distal portion was freed down to the levator ani muscle.

The patient was then placed in the lithotomy posture, and a purse-string suture was passed about the anus. An incision circumscribing the anus and extending over the coccyx in the mid-line was then made in the perineum, the coccyx was resected,

and the rectum and anus were freed from below, the dissection being continued until the entire loosened segment of gut could be removed through the perineal wound. This wound was then closed, with drainage. The patient was then placed in the dorsal position, the levator ani muscles and the peritoneum were sutured, and the abdominal wound closed.

The patient made a slow but satisfactory recovery.

The specimen removed was made up of the rectum and the lowermost portion of the sigmoid, measuring 27 x 7 cm. There was a large hard mass projecting into the lumen of the gut. On section through the tumor, the new growth was found to have infiltrated the fatty tissue about the rectum. One small nodule was found in a mass of fat 10 cm. above the site of the original growth. Microscopically, the mass was shown to be carcinomatous.

Dr. Martin said the case seemed to be of interest on account of the presence of the secondary mass 10 cm. above the main growth, emphasizing the advantage of approaching these tumors through the abdomen from above.

DR. WILLIAM C. LUSK said that Hochenegg, in 1902, had published a tabulation of various operators of cases of carcinoma of the rectum, operated upon by the posterior route, to which he himself in 1908 had added a few other collected cases, making a total of 1244, among which there was freedom from recurrence after three years in 15.6 per cent.

DR. JOHN A. HARTWELL said he had looked up some 50 cases of carcinoma of the rectum which had been operated on by different surgeons in New York, most of them by the sacral or perineal route, and he had found that only 17 per cent. had remained well for three years, and the recurrences had all taken place at the local site of the operation.

Dr. Hartwell said he could recall at least three recent cases of resection of the rectum, in which, in order to save the sphincter, the bowel had been cut off within less than an inch beyond the limits of the malignant growth. The speaker said he did not favor such a procedure, and he was inclined to agree with Dr. Martin that it was much safer to make the excision very complete and do a left-sided colostomy. Even in cases where an effort was made to save the sphincter, a stricture or incontinence was very apt to result, which was quite as troublesome as the presence of an artificial anus.

KAMMERER said he entirely agreed with Dr. Hartwell.

In his efforts to save the sphincter, he now believed that he had often failed to remove a sufficiently large portion of the bowel. He very rarely did resections of the rectum at present, after which strictures were apt to develop and later on recurrences. The method which he favored was to do a colostomy, and then excise the growth, dropping the closed end of the rectum back into the wound without attempting to bring it down to the anal site. After establishing the inguinal anus, it was comparatively simple to remove the growth by the sacral route, closing the rectum high up, and suturing the opened peritoneum to the stump of the sigmoid. More especially in neglected, far-advanced cases, which one will always meet in hospital practice, this operation was the operation of choice. He could say from his own experience that the mortality, even in desperate cases, was very small.

DR. LUSK said that in suitable cases, where the sphincters were well free from the disease, he would favor resection of the rectum by the combined method rather than amputation. By bringing down the sigmoid flexure for anastomosis with the anal segment and including a good margin of serous surface of the former piece of bowel in each stitch of the suture line, union was made more sure, and the tendency to extensive breaking down of the suture line diminished. A stricture of the bowel need not necessarily follow resection, the conditions favorable for avoiding this sequel being good nutrition of the bowel ends and in even coaptation of the mucous edges. A paralysis of the sphincters would not occur unless the nerves were cut.

DR. ROGERS, replying to Dr. Lusk, said that the nerves supplying the anus lay to the upper side of the levator ani, and if that muscle was detached, paralysis of the sphincter necessarily followed.

DR. LUSK said that the nerve supply of the external sphincter was from the inferior hemorrhoidal and perineal branches of the internal pudic nerves, which branches were all situated below the levator ani muscles. The interior pudic nerves had their origin from the third and fourth sacral roots, and paralysis of the external sphincter had resulted from the cutting of these nerve-roots in high division of the sacrum. The nerve supply of the internal sphincter was from the sympathetic, and could likewise be preserved.

DR. KAMMERER said that when he spoke of a stricture following a resection of the gut, he referred, of course, to a relative

stricture, which caused a certain amount of stagnation and irritation, even if the patient was not conscious of the same. As regards the combined operation in one sitting with the establishing of an inguinal anus and removal of the entire lower segment, he did not believe it had any advantage over the method he practised. If one has decided on a permanent inguinal anus, why not give the patient the benefit of the same some weeks before removal of the rectum? The improvement in the general condition of the patient and more especially the change in size and mobility of the tumor itself are often very striking.

DR. MARTIN, in closing, said there seemed to be some confusion as to what was meant by the "combined operation," and this fact should be considered in connection with the high mortality, to which Dr. Kammerer had referred. The mortality was high in those cases where an attempt was made to unite the two segments of the divided gut. But in the combined operation, in which a permanent inguinal anus was established, and the entire lower segment of gut including the anus was removed, the mortality in Dr. J. A. Blake's series had been strikingly small—18 cases with no deaths.

DR. GREEN, in closing, said the choice of operation in carcinoma of the rectum depended somewhat on the character of the case. In women, for example, it was easier to do the combined operation, while in fat men it presented many difficulties. Personally, he thought that if the combined method was feasible, it was beyond question the proper mode of procedure.

In his own case, Dr. Green said, the carcinoma was of the colloid type, which he believed was more apt to recur at the site of the operation rather than in the form of metastases. If this should be the case a second chance could be offered the patient in the combined operation.

RECKLINGHAUSEN'S DISEASE.

DR. ALEXIS V. MOSCHCOWITZ presented a girl, 14 years old, a native of the United States, of Roumanian descent, who was admitted to the Har Moriah Hospital on May 17, 1911, for the correction of a congenital deformity of the scalp and neck which had become particularly annoying during the past few years. Prior to her admission to the hospital she had been under treatment at various institutions, but at no place was any operative treatment proposed.

Examination showed innumerable pigmented areas, varying

in size from a pin-head to a silver quarter-dollar, distributed over the neck and trunk. Practically the entire right half of the neck was covered by one such pigmented area, studded with numerous nipple-like elevations, of a soft consistency. The entire occiput was involved in a mass of irregular shape about the size of an adult palm. This mass had no distinct pedicle, but it was pendant, and in some respects resembled a cap. It was soft and somewhat cystic, and for the most part painless, excepting just behind the auricle. Within the greater bulk of this mass there could be palpated a number of distinct nodes, of a much firmer consistency than the mass itself, varying in size from a marble to a hen's egg. Upon the periphery of the main growth there were a number of outlying smaller tumors (Figs. 1 and 2).

In connection with this case, Dr. Moschcowitz stated that this patient possessed only a fair degree of intelligence, being about two years behind in her school work. He also called attention to the fact that both sternoclavicular joints were very lax, the left one to such a degree that it could be luxated at will.

Recklinghausen had described a triad of symptoms for the malady known by his name; these were (1) the pigmented areas of the cutis; (2) the nerve tumors; and (3) the retarded intelligence. All three of these were present in this case.

The patient was operated on by Dr. Moschcowitz on May 22, 1911. The operation consisted of an excision of the area chiefly affected, followed by a plastic operation and subsequent suture. Because of tension, the central portion of the wound was left open, the idea being to graft it on a subsequent occasion, but this proved unnecessary, as the entire wound very quickly granulated and became covered with epithelium. The text-books speak of alarming hemorrhages during these operations, but in this case the bleeding was very readily controlled. At a second operation, on February 11, 1912, several neuromata were excised from the neck and submental regions, followed by plastics to improve the cosmetic effect. Further corrective operations were still in view.

Pathological examination revealed the presence of true and false neuromata, with very large, thickened nerve-trunks.

TRIFACIAL NEURALGIA.

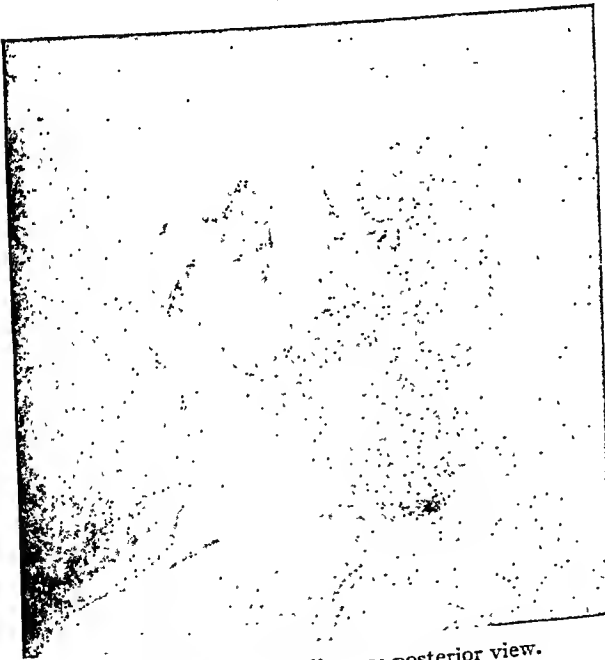
DR. MOSCHCOWITZ presented a woman of 54, who for over 20 years had been suffering from trifacial neuralgia, and when he was first asked to see her by her physician, Dr. Wm. Hirsch,

FIG. 1.



Recklinghausen's disease; lateral view.

FIG. 2.



Recklinghausen's disease; posterior view.

she was suffering very intensely from attacks which recurred every three or four minutes.

The woman was admitted to Mt. Sinai Hospital, where Dr. Moschcowitz operated on her on November 11, 1911, under local anæsthesia; the operation consisting of isolating the individual nerves at the point of exit from the foramina, twisting them out according to the Thiersch method, and then tightly plugging each foramen with a silver button, as described by him in the *New York Medical Record*, February 16, 1907.

Dr. Moschcowitz said he was in favor of the Hartley-Krause operation in cases where it was imperatively demanded, but he thought these patients should first have the benefit of a less drastic surgical procedure.

In reply to a question, Dr. Moschcowitz said the operation was done entirely under local anæsthesia. The speaker said he had done this operation about 15 times. In this particular case, the second and third branches of the nerve were resected and twisted out, and the foramina plugged, and in none of his cases had he had occasion to remove the plugs afterward. In one case there had been a recurrence, and a Hartley-Krause operation subsequently became necessary. The object aimed at in this operation was to prevent reunion between the distal and proximal segments of the nerves.

TRIFACIAL NEURALGIA: SECTION OF THE POSTERIOR ROOT OF THE FIFTH NERVE PROXIMAL TO THE GANGLION.

DR. ALFRED S. TAYLOR presented a man, 27 years old, who in the summer of 1902 first experienced pain in the right side of his nose. This lasted for five or six weeks, and recurred in cycles at intervals of several months, gradually becoming more severe. He tried various medicinal and hygienic courses of treatment, and in June, 1910, he had a peripheral operation done on the right infra-orbital nerve at its exit from the foramen. The foramen was not plugged and no relief followed the operation. On the contrary, the attacks of pain became more severe and frequent, and in July, 1911, he had constant spasms of pain, involving chiefly the third branch of the nerve; these attacks would be aggravated by talking or eating, and were so severe that he thought they would drive him insane.

About this time the patient, who came from Texas, was seen by Dr. William A. Downes, who referred him to Dr. Taylor.

Operation, November 11, 1911: Through the Hartley-Krause approach made on the right side, the dura was pushed away from the skull, and the posterior root of the fifth nerve divided proximal to the ganglion. The wound was closed without drainage, and primary union followed, but on the fourteenth day there was a small collection of serum under the anterior edge of the wound. This was aspirated, and following this a small sinus persisted for a few weeks, through which cerebrospinal fluid was discharged. The sinus then closed. The patient had been absolutely free from pain since the operation.

Dr. Taylor said this operation was first suggested by Frazier, of Philadelphia, after rather extensive animal experimentation. Its advantages were that it was comparatively simple, and that there was no interference with the nerve ganglion, which was left to perform its natural functions. After extirpation of this ganglion, interference with the nutrition of the eye on the affected side was exceedingly common; in this case, there had been practically no difficulty with the eye.

DR. OTTO G. T. KILIANI said the case shown by Dr. Taylor was unusual in that the freedom from pain was not accompanied by anæsthesia in the involved areas, because a ganglion operation or resection of the root proximal to the ganglion, in addition to the loss of pain, must produce complete anæsthesia. As to the eye symptoms following this operation, the pupil on the affected side was decidedly dull, although there was apparently no corneal involvement.

Dr. Kiliani said he had seen a number of cases of trifacial neuralgia where there was freedom from pain for over two years after an injection of alcohol, but even a period of over three years did not prove that the case was permanently cured.

DR. ROBERT T. MORRIS said that in connection with this subject of a radical operation for the relief of trifacial neuralgia, he wished to emphasize the importance of first excluding every possible source of peripheral irritation, such as the teeth, eyes, nose, etc. He could recall a number of cases where the patients were subjected to a radical operation without any preceding inquiry into these possible sources of peripheral irritation. He had seen this sin of omission committed by famous neurologists, and he felt convinced that if in every case of trifacial neuralgia these various sources of peripheral irritation were to be sought for and corrected, there would be fewer instances where a radical

operation would be thought necessary. Many neuralgias are precipitated in susceptible individuals by toxic impression from a distant source as well as by peripheral irritations.

DR. TAYLOR, in closing, said there was apparently no anæsthesia in this case; the man was able to feel just as well on one side of the face as the other. There was no possibility of error as to the fact of the division of the nerve in this case, as the ganglion was exposed and manipulated with the forceps, and the various bundles of fibres that made up the root were inspected before the division of the latter. One simply had to take the patient's word for it that he could feel as well on one side of the face as on the other.

PARTIAL GASTRECTOMY FOR PRIMARY LYMPHOSARCOMA.

DR. A. V. MOSCHCOWITZ presented a man of 50, who was admitted to the Mt. Sinai Hospital on June 3, 1911, complaining chiefly of a dull pain in the epigastrium, accompanied by vomiting, and with marked emaciation. On examination, there was found a movable tumor in the epigastric region. Repeated examinations of the gastric contents gave the following average findings, which were very much at variance with the usual results of gastric analyses found in carcinoma of the stomach: total acidity, 60; free hydrochloric acid, 20; lactic acid, absent; no Boas-Oppler bacilli, and a positive reaction for blood. An X-ray examination revealed an indentation of the greater curvature of the stomach, with retarded motility.

Operation, June 22, 1911: A tumor the size of an adult fist was found on the proximal side of the pylorus, involving the stomach wall, which it encircled. A few enlarged glands were found on both the greater and lesser curvatures. The growth was resected, and the operation completed according to the II Billroth method. After closing the proximal end of the stomach, there remained merely a narrow pouch—practically only a tubular prolongation of the œsophagus, into the posterior surface of which the jejunum was implanted.

The pathological examination of the excised tumor and lymphatic glands was made by Dr. F. S. Mandlebaum, and was pronounced a primary lymphosarcoma.

The patient made an excellent convalescence, and left the hospital on the twenty-first day with his wound completely healed. Since then he had regained his normal weight.

Dr. Moschcowitz said that while it was thus far too early to speak of a cure, the result was at least very encouraging, and this fact, together with the comparative rarity of primary lymphosarcoma of the stomach, merited the presentation of the case.

PARTIAL THYROIDECTOMY.

Dr. JOHN ROGERS presented a woman, 24 years old, who had a small thyroid enlargement which had existed about nine years. It had given rise to no symptoms until about four years ago, when she began to complain of weakness, hot flushes, nervousness, and occasional palpitation. These were accompanied by some enlargement of the thyroid, and appeared after she began to work hard as a servant. In April, 1911, she consulted a surgeon, who did a partial thyroidectomy, following which there was no improvement in her symptoms, and since then they had gradually grown more severe. The surgeon now wished to remove half of the remaining lobe of the thyroid.

Dr. Rogers said his object in showing this patient was to illustrate the inadvisability of operating on some of these cases for the relief of symptoms which were supposed to be of thyroid origin. In this case there had been no continuous tachycardia—it occurred only after exertion or excitement. When the patient was quiet the pulse was regularly normal. The blood-pressure had been low, averaging about 90 mm., and the pulse slow.

In such a case, Dr. Rogers said, it has been his experience that no benefit was to be derived from an excision of the thyroid. Her symptoms belonged entirely to the sympathetic nervous system, and the enlargement of the thyroid was simply compensatory, and had to do with the chromaffin secretions. This patient had improved somewhat since the operation under the administration of the adrenal nucleoproteid, $\frac{1}{4}$ gr. every 3 or 4 hours, combined with the thyroid proteids. She represented a group of cases characterized by goitre (without noticeably constant hypo- or hyperthyroidism) and extreme nervous irritability. Under exertion or excitement the goitre generally enlarged from evident congestion, and some hyperthyroidism was then apparent. If the goitre is partially excised there follows either hypothyroidism as in this instance, with its peculiar pallor, dry skin, subnormal temperature, constipation, headache and asthenia and no relief of the nervousness; or the remaining half of the thyroid degenerates and causes a continuous and severe hyperthyroidism instead of the mild alternating hyper- and hypothyroidism. In

these cases the primary disturbance should be regarded as a fatigue of the thyroid which is really secondary to the nervous irritability. The gland seems constantly and unduly called upon to "make good" in some error in nutrition in the nervous or chromaffin system. The thyroid should therefore *not* be ventilated, but it should be rested by section of enough of its nerve and blood supply to stop any of the signs of hyperthyroidism. The hypertrophy is not pathological but compensatory to an increased demand upon the thyroid secretion.

DR. MORRIS said he was very glad that Dr. Rogers had brought up this subject of relative hyperthyroidism. The speaker said he had a patient under his observation at present who was operated on about a year ago for an enlarged thyroid, when the arteries of the gland were tied, without improvement. The patient had been referred to Dr. Ludwig Kast, who reported that the case was one of relative hypertrophy of the thyroid, and that removal of the gland would not do any good. In relative hyperthyroidism the thyroid is doing normal work, but the chromaffin group of glands is not doing normal work, consequently the thyroid appears to be acting morbidly, when in fact the chromaffin group is at fault instead.

DR. KAMMERER said that he had recently operated on a young girl for a thyroid enlargement, with marked tachycardia on the least exertion, and slight exophthalmos. The case was evidently one of incipient Graves's disease, somewhat similar to the case presented by Dr. Rogers. He had removed half of the gland and he asked Dr. Rogers if it were possible to distinguish, at this stage, cases of pure hyperthyroidism from such cases as the one he had presented, which developed symptoms of hypothyroidism after removal of part of the gland.

DR. ROGERS said these cases were often very puzzling, and there were no hard and fast rules to act as guides. In cases where the skin was moist, with slight elevation of temperature and a more or less constant tachycardia, the indications were that one had to deal with hyperthyroidism; but with pallor, headache, anaemia, constipation, a dry skin, and a subnormal temperature, the indications were that one had a hypo- rather than a hyperthyroidism, and thyroidectomy was contraindicated. In the case he had shown there was never any constant tachycardia, and the blood-pressure was low; there was only the vasomotor irritability and the nervous excitability with the goitre.

Partial thyroidectomy should have much more restricted indications than seem to be considered necessary. For all cases which show the symptoms usually considered those of hyperthyroidism, the interference should be limited to section of the blood and nerve supply of the thyroid, and both superior and both inferior groups of vessels should be tied before proceeding to the more radical operation. All four of the arteries can be tied without the least ill effect and generally with the greatest benefit.

ADHESIONS OF THE UPPER ABDOMEN.

DR. ROBERT T. MORRIS read a paper with the above title, for which see page 804.

DR. HENRY H. M. LYLE said that at the Congress of French Anatomists a year ago the fact was brought out that in the duodenum there was a normal valve which had often been mistaken for a constriction. It was present in the foetus as a constriction; at five to six years, it was a definite valve with circular muscular fibres. According to Villemin this valve is 1 to 3 cm. proximal to the duodenojejunal angle, shows a definite muscle, and the glands of Brunner stop on the proximal side of the valve. This is the true line of division between the duodenum and jejunum.

DR. GEORGE WOOLSEY said the pathology advanced by Dr. Morris in regard to the occurrence of these adhesions in the abdomen did not appeal to him. He did not understand why the reader of the paper had selected the toxins as the causative factor of such adhesions. These toxins were either foreign proteids or alkaloidal bodies and could not pass through the walls of the hollow version when relatively intact. We knew that bacteria did occasionally pass through these walls and that they would produce adhesions. We did not know that they were caused by toxins, and he thought it would be both simpler and safer to stick to the accepted explanation that they were due to bacterial inflammation.

DR. WINFIELD S. SCHLEY asked Dr. Morris if he had used sterilized olive oil in place of petrolatum to prevent intra-abdominal adhesions. Considerable experimental work had been done in that direction, and the latest theory was that olive oil was preferable to either paraffin or petrolatum. The olive oil should not be boiled but simply sterilized by fractional sterilization, boiling splitting up the fatty acids and making for irritation.

He had used such olive oil in several cases of intestinal obstruction where the obstruction was accompanied with dense and extensive adhesions following peritoneal suppurative conditions, and so far in these cases the results had apparently been good, not only as the general condition of the patient was most excellent but the abdominal as well.

DR. ARPAD G. GERSTER said he thought the statement so often made that the introduction of olive oil or other fatty substances into the abdominal cavity after operation would prevent the formation of adhesions was based on some sort of delusion. It was possible that no adhesions formed after the introduction of such a substance, but that did not prove that their absence was due to the oil. Personally, he believed that the greatest safeguard against the prevention of intra-abdominal adhesions was to leave the peritoneal surface in such condition that no adhesions could form. This depended on a good technic, both operative and especially aseptic, and when one heard of a case where the wound healed without complication and shortly afterward disturbances occurred from adhesions, the suspicion naturally arose that the operation was not an aseptic one. We knew the tremendous tolerance of the peritoneum, and nature's defence in this region against traumatism and infection was the formation of adhesions. If the surgeon did his work in a thoroughly aseptic manner, very few adhesions would result. At Mt. Sinai Hospital, where a large number of cases of appendicitis and other intra-abdominal lesions are seen, many of them septic and in desperate condition, resulting adhesions were comparatively rare, and the speaker said he wished to protest against the rather popular belief that adhesions were a normal consequence of intra-abdominal operations. Slight adhesions that were not due to any severe form of infection would be easily disposed of by the ordinary peristaltic movements of the intestines. Of course, it was known that in cases requiring prolonged drainage, permanent adhesions might follow, but the speaker said he did not believe that in his entire experience he has had to reopen the abdomen more than two or three times on account of obstinate symptoms due to adhesions.

DR. MARTIN said that when the abdomen was opened for the relief of intra-abdominal disturbance and adhesions were found, it was assumed that the adhesions were responsible for the trouble, whereas the pathological condition causing these adhesions might easily be overlooked. He doubted the efficacy of

the introduction of foreign substances in the prevention of adhesion formation, as endothelium, he thought, did not grow in from the sides of the denuded areas like epithelium, but was formed by the modification of mesoblastic cells under the influence of pressure and motion; and that, although their immediate formation might be prevented, they would very readily re-form if any irritative conditions persisted.

DR. ROGERS said that last summer he operated on a patient for the relief of obscure abdominal symptoms, and upon opening the abdomen adhesions were found, which were divided, and the patient's symptoms were apparently relieved. A month later, the abdomen was again opened by another surgeon for a different cause, and adhesions, which were much more numerous than those met with at the previous operation, were found, yet the symptoms calling for the original operation had been relieved.

DR. SCHLEY said the introduction of an oily substance after an intra-abdominal operation permitted of greater mobility of the intestines, and practically the procedure seemed to prove advantageous. In some cases adhesions occurred very rapidly, and it was possible that by the introduction of olive oil or a similar substance, the greater mobility of the parts thus induced might tide the patient over for a sufficiently long time to prevent the occurrence of such adhesions. The use of such substances of course would be chiefly in cases where extensive adhesions had been separated and considerable areas of peritoneal investment were wanting. There was considerable difference in the rapidity and degree to which individuals acted toward peritoneal irritation and formed adhesions, and considerable difference in the degree of resolution or melting away of such adhesions after the cessation of this irritation. If there was anything promising in some of these bad cases it was worth trial, as in a number a chronic peritonitis with new tissue formation followed.

DR. KAMMERER said his experience with oily substances in these cases was very limited. They seemed to him, however, to have a distinct value. On the denuded surface of intestines they acted as a covering, beneath which healing took place, and through which the formation of adhesions with other viscera, at least to a certain extent, prevented mechanically.

DR. LYLE said in regard to the part played by the bacteria in chronic peritonitis and the formation of peritoneal adhesions one

must not forget the rôle played by the anaërobic bacteria. The subject has been very ably handled by Heyde in *Beitrag. zur klin. Chir.*, October, 1911.

DR. MORRIS, in closing, said that in connection with his work on this subject, he had carried out a number of experiments on rabbits and dogs, and he had found that after an intra-abdominal operation adhesions were more or less apt to occur, no matter what precautionary measures were used, and that they could be lessened by any method which would permit new endothelium to cover the denuded surfaces.

In regard to the choice of an oily substance to prevent the occurrence of intra-abdominal adhesions, Dr. Morris said it seemed to him that the animal oils were absorbed more rapidly than any other; the vegetable oils came next in order, while the mineral oils, particularly those of the paraffin group, were taken up much less rapidly, and for that reason he had come to depend largely on mineral oils of the heavier type, which were absorbed very slowly and would keep the visceral surfaces apart during the interim when plastic lymph would be most apt to lead to adhesions. By thus introducing a mechanical obstacle to the formation of adhesions, time was afforded for new endothelium to cover the defect.

Dr. Morris said he was surprised to hear Dr. Gerster's remarks on the subject of adhesions in general. If he admitted that the Lane kink was productive of symptoms, as most of us believed, then we might assume that still more extensive adhesions in other parts of the peritoneal cavity would lead to greater trouble. The speaker said he had seen many cases of supposed gall-stones where as a matter of fact the symptoms were due to the presence of adhesions. The severity of the symptoms depended not so much on the extensiveness of the adhesions as upon their particular location.

Dr. Morris said he was interested in Dr. Lyle's statement that these upper abdominal adhesions had been attributed to the presence of anaërobic bacteria, and that he would be pleased to make further investigations along that line. The influence of anaërobes furnishes a new and promising field for study.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held March 4, 1912.

The President, DR. GWILYM G. DAVIS, in the Chair.

GENERAL INFECTION FOLLOWING ACUTE TONSILLITIS.

DR. WILLIAM J. TAYLOR read a paper with the above title, for which see page 785.

DR. JOHN H. JOPSON reported the case of a boy of 18 who during the past winter had been the subject of repeated attacks of acute tonsillitis, two or more of these attacks being succeeded by attacks of pyelitis or, as his physician, Dr. Geisler, diagnosed them, ureteritis. The connection between the two conditions was apparently very definite, and the kidney condition was exceedingly acute and disabling. Finally his tonsils, which were badly infected, were removed by Dr. Stout, and since then he has remained well.

DR. WALTER G. ELMER recalled a case which came under his own care. This was a lady 73 years of age in which the infection travelled from her throat through the Eustachian tube to the middle ear, her temperature reaching 105.5°. This was followed the next day by diffuse abdominal tenderness, marked distention, and marked tenderness over the appendix, so that in a younger subject a diagnosis of acute appendicitis would have been made and operation advised. She being 73, and the fact that the ear was relieved by drainage and the symptoms subsiding, of course operation was not considered. This case, however, shows the similar relationship between throat infection and the abdominal cavity of which Dr. Taylor spoke.

DR. CHARLES F. NASSAU said that some four weeks after a total hysterectomy, the patient being perfectly well and at her home, she developed an acute tonsillitis. This was treated by a physician who evidently cleaned out some tonsillar crypts. The

patient said it had caused her great pain. About 48 hours after that she developed a thrombophlebitis of the right femoral vein and since then she has had a periurethral abscess. At no time was there any trouble with the hysterectomy wound, although that is necessarily under suspicion; but she had been so well prior to her tonsillitis that he could not think her later trouble had anything whatever to do with her abdominal operation, but was a spread of infection from the tonsils.

DR. JOHN B. ROBERTS said that he wished that Dr. Taylor's paper could be read by all laryngologists, who are so earnest and anxious to radically remove the tonsils of many children, between five and fifteen years of age. Dr. Taylor says that it was suggested, at the meeting in Budapest, that the tonsils be taken out in cases of acute rheumatism, because of the connection between tonsillar infections and this infection of the joints. His own feeling had been that nature puts the faucial tonsils, the pharyngeal tonsil, and the lingual tonsil at the opening of the gastro-intestinal canal as a protection against general infections. When infection gets into our mouths the tonsils probably act as a filter plant, in a manner similar to the action of the inguinal and axillary glands, which catch the micro-organisms which come from the lower and upper extremities respectively. Therefore it is a very unwise thing to take out radically either moderately diseased or occasionally diseased tonsils of a child until we have more authoritative knowledge of the functions of these juvenile organs. These cases of Dr. Taylor's show apparently that the first place the infection stopped was at the tonsil. Of course if the infection gets beyond the tonsils, either because the tonsils have been removed or because their filter function is not in good working order, general infection occurs and may show arthritic, abdominal, or other symptoms.

DR. ROBERTS related a case in which the tonsils and adenoids in the pharynx were extirpated for a young child, in whom it had been advised that the pharyngeal adenoid tissue be removed, because of earache. To his surprise the operator also removed the slightly enlarged tonsils. A few months later the child died of a very acute cerebrospinal infection, proved by autopsy and monkey inoculation. It is asserted that that disease, the so-called anterior poliomyelitis, comes usually through infection of the pharynx. Does it not seem possible that the acuteness and severity of the general infection in that particular patient were greater because

one of the safeguards of the system, the tonsils, had been removed a few weeks prior to the time the bacterial cause of the disease happened to reach the mucous membrane of the child's throat?

DR. DAMON B. PFEIFFER related the history of a medical student who had fractured the external malleolus of the right fibula. While in the hospital he had a severe attack of tonsillitis, bilateral; he previously had had tonsillitis many times when a child, and claimed that the tonsils had been removed by cauterization, but there evidently was some submerged tissue which was not removed. He was given the ordinary treatment, in spite of which a tonsillar abscess formed, which was incised and considerable pus evacuated. He left the hospital in a few days and went home to recuperate. A few days later he noticed blood in the urine, which, upon standing, was sufficient to form a clot in the sedimented portion and he is now suffering from a very severe hemorrhagic nephritis.

THE RADICAL CURE OF HERNIA.

DR. CHARLES F. NASSAU read a paper with the above title, for which see page 857.

DR. RICHARD H. HARTE said that there is one important feature that is often overlooked in the question of operation for hernia, and that is the importance of having the wound thoroughly dried before closing. This is often responsible for the failure to get absolutely clean, healthy wounds. He firmly believed that this is the reason why so many men whose technic cannot be questioned get suppuration, from hemorrhage setting in after the reaction of the patient.

DR. JOHN H. JOPSON could not agree with Dr. Nassau as to what he says of the lack of value of the rectus transplantation by the Wölfler method. He had nearly always incised the anterior covering of the rectus muscle when transplanting it, which he has done many times, in hernias, where the conjoined tendon was poorly developed, and he included in his stitches the conjoined tendon, and if the incision in the sheath is made of a fair length, one can bring the rectus muscle down to the desired point on Poupart's ligament without undue tension.

DR. WILLIAM L. RODMAN believed that transplantation of the anterior sheath of the rectus is one of the most important steps that has been made in operations for hernia. It seemed to him that the transplantation of the sheath itself is more

important than the fibres of the muscle, because the latter would atrophy soon after transplantation and be of no real resistance to the future descent of a hernia. Another very important point is whether or not the cord shall be transplanted in the average case. Formerly he believed that the technic of Bassini was much the best, and he was prepared to believe so yet in a majority of cases; still he did not feel at the present time that it was absolutely necessary to transplant the cord in every case. Certainly it is a distinct disadvantage in some; as, for instance, if we have associated an undescended testis where the cord is already too short. It also seems an unnecessary step in the average case, in children, because almost any operation in them will be followed by cure. He had been omitting this step increasingly in the last five years, and although it was impossible for him to say that all these cases had done as well as where the cord was transplanted, as he had not reviewed them, yet that was his impression. Transplantation is necessary in direct hernia particularly, but in oblique hernias it may be an unnecessary step.

Most important in hernia operations is the choice of suture materials. Bassini used silk in his operations, and many others also until a number of fistulæ or sinuses caused them to abandon silk. He formerly used silk a great deal because he had not sufficient confidence in catgut or kangaroo tendon; but for the last 10 or 15 years he had very generally preferred the absorbable suture, and the best is small kangaroo tendon. Kangaroo sutures as generally used are much larger than is necessary and the knots have been the cause of trouble in the majority of instances; to this he attributed his late infections years ago. Small kangaroo tendon can be as completely sterilized as anything else and is sufficiently abiding. A suture should abide for three or four weeks to insure safety. The use of rubber gloves also has done more to make the results in hernias good than anything else except the absorbable suture materials. The use of gauze dissection is not disadvantageous if done carefully.

As to the use of cocaine, while it is undoubtedly a valuable advance, yet it is for the exceptional rather than the ordinary case. Where there are distinct contraindications to ether, cocaine should be used exactly in the way Dr. Nassau has shown. He had witnessed failures in the hands of those most familiar with cocaine.

DR. CHARLES F. NASSAU, in closing, remarked that he had

stated that Bloodgood in his transplantation utilizes the outer border of the rectus muscle behind the internal oblique and in front of the peritoneum. Dr. Halsted has in certain isolated cases utilized the whole sheath to cover the defect, but in the Wölfler method it is pulled out through the anterior sheath, and in Bloodgood's method the retractor is introduced beneath the internal oblique and transversalis and by pushing back the bladder the incision is made (along the outer border of the rectus), and the whole strength of the anterior sheath is then left to cover over and it may even spread out after the edge of it is freed. These are the advantages and differences between Wölfler's and Bloodgood's transplantations, it being the transplantation of the rectus muscle, not of the sheath, in any sense whatever, in every method.

He did not go into the question of suture material as he considered it unimportant. His own preference is for silk when the work is being done where he knew the silk stays in. In the Frankford Hospital where he had control of the technic and had had the same operating room nurse for years, he used silk almost exclusively as a buried suture until the last three years, when he had been using catgut, although also using silk in selected cases. He had taken out but one silk stitch from an inguinal hernia; he had taken out two buried silk sutures in seven years, and both of these he put in himself, the second time being in an epigastric hernia. Chromicized catgut, if the best brand is used, is all right.

In the question of operation under local anæsthesia, if the patient squirms over the table, suffers pain, and the surgeon is worried and things are prolonged, then it is better not to operate in this manner. On the other hand, if the surgeon does not make a reasonably persistent effort to master that technic in a certain number of cases, when the time comes where he needs it he cannot do it except his patient suffers pain, and he therefore does an incomplete operation. In one patient of 75, the only one of the series in which he resected nine inches of bowel, this was done painlessly and the old man got well. Through the courtesy of Dr. DaCosta he had two men patients in the wards at the Jefferson Hospital at the present time, both of whom went through their operations well, and he would be very glad to have any who are interested go in and see them. They lay on the operating table in perfect comfort with the exception of slight

sensations at one or two spots where they warned him he was impinging on tender ground. The thing can be perfectly accomplished if one gives a little time to it.

TWO CASES OF CAVAL OCCLUSION: (1) VENA CAVA INFERIOR; (2) VENA CAVA SUPERIOR.

DR. PENN G. SKILLERN, JR., described these cases with remarks.

CASE I.—A man, 20 years of age, in April, 1910, contracted enteric fever, for which he was treated in the Pennsylvania Hospital for three months. During the third month of the disease he noticed that both legs were slightly flexed, painful, tender, and beginning to swell. They have remained swollen since. Pain started in feet and extended upward to pelvis, and also to the right lumbar region, which latter was but temporary. About two months after discharge from the hospital he noticed for the first time enlargement of the superficial veins, first in the left inguinal region, from whence the veins "began coming out all over"; he did not notice the time or order of appearance of the veins after this. These veins have not decreased in size until one week previous to this report (Feb. 26, 1912), when he noticed for the first time that they were undoubtedly diminishing in size. He feels well in other respects: no gastro-intestinal disturbances, not even piles.

Examination reveals an ulcer over each shin, in the course of the internal saphena, both 2 cm. in diameter and both presenting the usual characteristics of varicose ulcer. Moderate œdema of legs and feet.

After elevation of the lower extremities against the wall for 15 minutes, to gravitate as much of the fluid as possible from the limbs, each limb was encased in an Unna's paste dressing from the roots of the toes to the tibial tubercles.

Examination also revealed the condition of the superficial veins shown in the accompanying photograph (Fig. 1).

Along the course of both saphena there were dilated venules, taking for their pattern the delicate tracery of fine seaweed. The course of dilated and tortuous veins on the respective sides was noted as follows:

Right side. Thigh: Superficial circumflex iliac between saphenous opening and anterior superior iliac spine, just below

FIG. 1.



Enlargement of superficial veins consequent upon occlusion of the vena cava inferior.

sensations at one or two spots where they warned him he was impinging on tender ground. The thing can be perfectly accomplished if one gives a little time to it.

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Right side. Thigh: Superficial circumflex iliac between saphenous opening and anterior superior iliac spine, just below

which it was markedly tortuous and enlarged. Abdomen: A dilated and tortuous vein receives the column of blood from the superficial external circumflex iliac and conveys it to the right axilla, passing lateral to the nipple. The superficial epigastric runs upward near the outer border of the rectus to inosculate with the superior epigastric. The superficial external pudic joins with its fellow. Chest: Anterior perforating cutaneous branches of internal mammary are more prominent below than above the nipple.

Left side: Thigh: Vascular mass over the saphenous opening, representing ampulla of saphena, and simulating femoral hernia. At the middle of Poupart's ligament there is the greatest dilation, the vessel here being 2 cm. in diameter as measured by the calipers. Abdomen: Superficial epigastric takes a prominent part. It sends a branch toward the navel which suggests the coeliotomy vein of Kelly, and which divides at the level of the navel, one branch inosculating with the superior epigastric, while the other makes almost a bee-line for the nipple, just short of which it disappears. Most of the current of the superficial epigastric, however, is diverted through a large tortuous vessel, which courses obliquely upward and outward to the middle of the axilla, and which corresponds to the *vena thoracica epigastrica longa tegumentosa* of Braune.

No noteworthy dilation immediately about navel. No piles. No varicocele. Area of hepatic and splenic dulness not increased. Examination of heart and lungs negative. Superficial cervical veins not enlarged.

The patient cherished an ambition to enter the service, so that the possibility of subsidence of the veins was pointed out to him. In the meantime he was advised to wear a leathern girdle with pelvic straps to support the vessels as well as to protect them from injury, and under no circumstances to permit excision of the veins.

Dr. Skillern recalled the statement of Osler that "There is no more interesting subject of study than the way in which channels of collateral circulation are established in occlusion of large vessels." As a corollary to this, he thought an equally interesting subject of study was to diagnose the character and location of the occlusion as indicated by the topography of the enlarged veins. In this case it is clear that we have to deal with a pre-

viously occluding but now canalized thrombus situate at the beginning of the vena cava inferior just above its great iliac tributaries. It could not be in one of the iliac veins, as in the case depicted by Ashhurst (*Jour. A. M. A.*, 1907, xlviii, 1840), and in that by Davis (*Applied Anatomy*, 1910, 380), because of the bilateral involvement. There might be a thrombus in each common iliac, but this is very improbable, and is not in accord with the history of *simultaneous* swelling of both lower extremities. For the same reason the thrombus did not start in one iliac vein (or tributary) and propagate itself to the cava, or into the other common iliac. The history states that enlarged veins were first seen in the left groin, whence they spread in various directions. We can still reconcile this with the pathology, for until the veins on the left side began to enlarge the cava was not yet completely occluded, but the thrombus propagated itself retrograde to the current and occluded the left common iliac first and later the right. There is present, then, a T-shaped thrombus.

Nor was the thrombus as high as the diaphragm, as in the case reported by Osler (*Jour. of Anat. and Physiol.*, 1879, xiii, 291), in which there was great stenosis of orifices of hepatic veins, for this patient exhibited no signs of portal obstruction, to wit: enlargement of liver and of spleen, gastro-intestinal catarrh, and piles. Nor was it as high as the renal, owing to the absence of albuminuria, nor even as the spermatic, since there was no evidence of right-sided varicocele.

Direction of circulation was from below upward.

Welch in 1909 (*Allbutt and Rolleston, System of Medicine*, 1909, 751) states that there are reports of at least 140 cases of this affection, so that it is relatively rare. In addition to the superficial veins returning the diverted blood, there is also doubtless a deep collateral circulation by way of the subperitoneal plexus described by Sir William Turner, as well as by dilated venæ azygos minor et major. Were the burden of returning the blood borne wholly by the deep veins, diagnosis would be rendered difficult on account of the negative results of inspection.

CASE II.—Clinical Summary: Aneurism of aortic and popliteal arteries; compression of vena cava superior; extensive extracaval collateral circulation. Male, aged 46. No history could be elicited that bore any causal relationship to his vascular disease.

In July, 1907, he sought surgical advice for aneurism of the

right popliteal artery, and underwent the operation of ligation of the superficial femoral artery at the apex of Scarpa's triangle, right side.

In 1903, four years previous to this operation, he noticed the superficial abdominal veins beginning to enlarge. These veins shortly reached their present size, and have neither increased nor diminished in calibre.

Examination reveals a tall, fairly well-developed man, whose appearance is indicative of good health. Impact of heart against chest-wall greater than normal. Râles scattered throughout lungs. Liver enlarged, particularly in epigastrium. Area of splenic dulness increased. Hemorrhoids present. No inequality of pupils or of radial pulses noted; voice clear and resonant. No brassy, unproductive cough.

Regarding the dilated and tortuous superficial veins, these were noted as follows:

Lower extremities: No varicose veins, no varicose ulcers, not even legacies of these lesions nor scars about knees were observed.

Right side: Abdomen: Superficial epigastric ascends to 1 cm. below navel and deviates to the right to cross the level of the navel 3 cm. laterally. It then inosculates with the superior epigastric, which fuses with its fellow over the ensiform. Chest: A dilated vein runs from the middle of the axilla to the fifth intercostal space, where it disappears. Neck: Dilation of superficial veins, particularly about root of neck.

Left side: Abdomen: Superficial epigastric, smaller than its fellow, crosses level of navel 6 cm. from mid-line. In this portion of its course it loops over to join its fellow across pubic hair 3 cm. above root of penis and again just below navel. It then inosculates with the superior epigastric, which fuses with its fellow over the ensiform. From the ensiform a single vein courses upward in front of the sternum to join both external jugular veins. This single vein receives as tributaries the anterior perforating cutaneous branches of both internal mammary veins. As on the right side, a dilated vein runs from the middle of the axilla to the fifth intercostal space, where it disappears. Neck: Dilation of superficial veins, particularly about root of neck.

Remarks.—Unfortunately this patient became sensitive to a degree in regard to his condition, and it was only out of courtesy to Dr. Miller that he submitted to examination, which was rather hastily conducted in a dressing-room of the clothing shop. He

would not consent to be photographed, to have blood taken for a Wassermann test, nor to appear before a medical society. There is no doubt, however, that the site of the venous occlusion is the vena cava superior; this is attested by signs of portal obstruction, namely, enlarged liver, enlarged spleen, and presence of piles; by the venous dilation about the root of the neck; and by the great similarity of the collateral venous circulation to previously reported cases, particularly that of Osler (*Johns Hop. Hosp. Bull.*, 1903, xiv, 171), the photograph of whose patient shows a collateral venous circulation which is almost the exact counterpart of those in this patient. That the compression of the cava is aneurismal in cause seems justified by the presence of arterial degeneration as shown by the existence of the popliteal aneurism, and by the chronic cough, backache, and intercostal neuralgia from which he suffers. That the cause of the cardiovascular disease is obscure is admitted, but the probability of its luetic nature is suggested in the history. Whether the man's occupation as a salesman of clothing for 20 years up to the time the disease first appeared, during which time he was on his feet all day and constantly lifting more or less heavy wearing apparel, had any causal relationship with his vascular disease, is problematical. It is noteworthy that he attributed his trouble to worry, which may or may not have been a cloak to conceal the real origin of the malady.

Welch (*loc. cit.*, p. 755) in 1909 found records of 35 instances of obliteration of the superior vena cava. He states that one-third of the cases are due to thrombosis, but that most depend either upon pressure from without, as by aneurisms, or upon syphilis. Dilation of superficial veins is especially marked over the anterior wall of the thorax and upper part of the abdomen, as held in Dr. Skillern's case. After reviewing a train of head and arm symptoms and signs that might be produced by venous obstruction near the superior thoracic aperture, he says: "In the light of the whimsicalities of venous thrombosis, it is hardly necessary to add that the symptoms may be less marked, and may deviate from what might naturally be expected."

The essential differences between these two cases are, first, the direction of the current. In Case I, where the inferior cava was obstructed, the blood was conducted efferent from the femoral veins afferent into the axillary veins, so far at least as the superficial circulation is concerned. The direction of the current was

from below upward. In Case II, on the contrary, where the superior cava was blocked, the blood was conducted efferent from the innominate and axillary veins afferent into the femoral veins. The direction of the current was from above downward. Then in Case I the veins of the lower extremities were involved, and there were varicose ulcers, while in Case II these vessels were uninvolved, probably because compensation by way of the deep abdominal veins was sufficient to obviate too much positive pressure upon the saphena veins, while the femorals below the latter took care of themselves by means of their powerful valves. In Case I there was no portal obstruction, while in Case II this was marked. In Case I there were no dilated veins over the sternum or at the root of the neck, while such was the feature of Case II. In Case I the etiology was unmistakable, while in Case II it was most likely luetic. Finally, the difference in ages. The first patient was 20 years of age, far below the period of vascular decadence, while the second patient was 37 when his malady started—well within the period of vascular degeneration.

FRAGMENT OF FILIFORM BOUGIE NUCLEUS OF VESICAL CALCULUS.

DR. HENRY R. WHARTON related the history of a man, 30 years of age, who was admitted to the Presbyterian Hospital June 15, 1911, on account of retention of urine due to a close stricture of the membranous portion of the urethra; notwithstanding adequate dilatation of the stricture he continued to suffer from intermittent attacks of retention. Upon exploration of the bladder by a searcher a stone was felt. Median perineal apotomy was then done, and two calculi were removed, each of which had developed upon either end of a four inch long fragment of a filiform bougie. Upon inquiry it developed that the man had been treated for his stricture one year before at another hospital, and it was presumable that in the course of this treatment the fragment of bougie had been left in the bladder. The mechanism of the intermittent retention may be explained by the fact that at times one of the stones attached to the fragment of bougie was forced into the urethra during micturition and for the time occluded it.

DR. MORRIS BOOTH MILLER said that some three or four years ago he had almost an identical experience. While on duty

at the Philadelphia General Hospital he had a patient under his care with a persistent perineal fistula following an external urethrotomy. Nothing that he could do would close the fistula, so finally under ether he explored and found an incrustated filiform which had been cut off. The larger portion of it was in the bladder but a portion was in the urethra. Upon consulting the colleague under whose care the patient had previously been, he recollected that he had introduced two filiforms and thought they had both come out intact, but what had happened was that one had been cut off in the operation and a piece about three inches long had been allowed to remain in the bladder.

DR. THOMAS C. STELLWAGEN said that he had in four or five instances detected in the bladder with the cystoscope portions of a filiform bougie. The Gouley catheter is dangerous, for after long use the tip gets sharpened and cuts the end of the filiform, and the surgeon does not realize it.

Each filiform should be most carefully tested through the Gouley or set of Gouleys before using it, because the filiforms sometimes do not allow the Gouley to slide freely over them, and too much force may be used, and in this manner the end is forced into the bladder and cut off.

DR. A. P. C. ASHHURST said that it used to be taught by the late Prof. John H. Brinton that when the Gouley catheter has been passed down to the stricture over the filiform, it was safer to push both the filiform and Gouley catheter together, passing them both at the same time from this point on; because if one pushed the catheter onward over the filiform one surely would cut the end off the latter.

DR. G. G. DAVIS said that some filiforms are made of whalebone, some of the French of silk, others of hardened catgut or silkworm gut; the whalebone ones are quite brittle and they not infrequently break, while the French ones are more apt to double on themselves.

CORRESPONDENCE

GAUZE LOST IN A BONE CAVITY FOR FIFTEEN MONTHS.

EDITOR ANNALS OF SURGERY:

Gauze has been reported as left behind in many parts of the human anatomy, and has required removal later for irritation symptoms. Complete encapsulation of a gauze sponge left in a bone cavity is, I believe, unique and justifies the reporting of the following case:

Mrs. P., aged 55, Scandinavian, came into my service at the University Hospital in January, 1910, with the following history: In the spring of 1908 she fell and bruised her left leg, after which it pained her and caused some disability. There was no swelling and no skin injury. The later history is rather indefinite, but the pains continued and became worse, and in the fall of 1909 she was operated upon, the left tibia being opened and some bone removed. She obtained slight relief from the pain after this but it soon returned, and the operation wound never completely healed.

Examination showed the tibia enlarged in its lower third with a scar along its crest for six inches, and two sinuses running down to bare bone. Below the site of this old operation reaching almost to the ankle was a marked enlargement of the tibia, which was painful to point pressure, and gave the impression of œdema in the overlying periosteum. Temperature was 100.2°, pulse, 85; leucocytes, 4500. A diagnosis of abscess of the lower end of the tibia was made, and the patient was operated upon by the writer.

The old wound was first explored and the sinuses were found to be superficial and due to incomplete healing of the bone cavity. The bone was chiselled away and all unhealthy tissue removed. No communication with the lower lesion was found, so the front of the tibia was chiselled away over the swollen area, opening a large encapsulated abscess shut off from the old field of operation by a wall of dense bone. In this abscess cavity was found a folded piece of gauze about eight inches square. The two cavities

were merged, made aseptic, and filled with the Moorhof bone plug, and the woman made a good recovery.

By corresponding with the first operator it was learned that he cut a long trench in the tibia and filled same with the Moorhof bone wax. There was much bleeding and the bone wound was packed with gauze sponges to check it, and one of these sponges was evidently left behind in the extreme lower part of the bone cavity, and being covered by wax became entirely encapsulated.

It is quite a tribute to the Moorhof technic that such a result could be obtained and that the gauze remained *in situ* for 15 months, though the regular irritative result of the presence of gauze was finally manifested, resulting in abscess, which would probably without operation have perforated the anterior shell of bone at some distance from the scar of the old operation.

This case is, I think, unique, and only possible with the use of the Moorhof technic.

J. CLARK STEWART, M.D.,
Minneapolis, Minn.

CHRONIC OXYURIS INFECTION WITHOUT APPENDICEAL SYMPTOMS CURED BY APPENDECTOMY.

EDITOR ANNALS OF SURGERY:

The following case was seen at the Presbyterian Hospital in the surgical service of Dr. J. A. Blake, to whom the writer is indebted for the privilege of operating upon and reporting the patient. The case seems of interest, for in a rather extended search through the literature we have been unable to find a single report in which appendectomy has been done, not for symptoms of appendicitis but solely to determine its effect upon an intestinal infection with *Oxyuris vermicularis*. Many cases of appendicitis in which the appendix contained pin-worms have been reported, but the especial interest in this case lies in the fact that the patient has never had a symptom referable to the appendix.

M. L., age 54 years, married, female; was admitted to the Presbyterian Hospital on January 8, 1911, complaining of bearing down pain and a mass in the abdomen. These symptoms had been present for about eight years and were due (as was shown at

operation) to a large fibroid uterus weighing 14 pounds. She had also been troubled for about 20 years by pin-worms, which she had frequently noticed and which caused severe anal and perineal itching. During these 20 years she had from time to time made determined efforts to be cured of the worms, being treated at various dispensaries and by several private physicians. Most if not all of the medical means had been tried, including diet, cathartics, intestinal antiseptics, anthelmintics, and rectal medication. Examination of the stools of this patient before operation showed oxyuris and their eggs.

Under general anæsthesia a supravaginal hysterectomy was done by Dr. Blake, followed by an appendectomy by the writer. The patient made a smooth convalescence and was discharged, cured, January 28, 1911.

The appendix measured 8 cm. in length. Serosa was smooth, pale, and glistening. On opening the appendix it was found to contain soft brown fæces and six oxyrides, three of each sex. Over 450 microscopic sections of this appendix were prepared and examined, but no changes other than some swelling of the lymph follicles and a moderate infiltration of eosinophiles in the mucosa could be found.

The case has now been followed for a little over 14 months and has remained well in every way. She has complained from time to time of some anal itching, but this has not been severe and seems to be due to a slight eczema in this region. She has noticed no more pin-worms, and repeated examination of her stools have failed to show either oxyuris or their eggs.

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